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THE PRINCIPLES

OF

PSYCHOLOGY.

BY

HERBERT SPENCER,

AUTHOR OF "SOCIAL STATICS: OR, THE CONDITIONS ESSENTIAL TO HUMAN HAPPINESS SPECIFIED, AND THE FIRST OF THEM DEVELOPED."

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PREFACE.

The four parts of which this work consists, though intimately related to each other as different views of the same great aggregate of phenomena, are yet, in the main, severally independent and complete in themselves. The particular serial arrangement in which they should be presented, has consequently been in great measure a question of general expediency; and while the order I have chosen is one which seems, on the whole, the most advantageous, it is not one which all readers are bound to follow. A brief characterization of each part, will enable every one to decide for himself which he may best commence with.

The General Analysis (of which the essential portion was originally published in the *Westminster Review* for October, 1853, under the title of "The Universal Postulate," and reappears here with additional arguments and explanations) is an inquiry concerning the basis of our intelligence. Its object is to ascertain the fundamental peculiarity of all modes of consciousness constituting knowledge proper—knowledge of the highest validity.

The Special Analysis has for its aim, to resolve each species of cognition into its components. Commencing with the most involved ones, it seeks by successive decompositions to reduce cognitions of every order to those of the simplest kind; and so, finally to make apparent the common nature of all thought, and disclose its ultimate constituents.

While these analytical parts deal with the phenomena of

intelligence subjectively, and, as a necessary consequence, are confined to human intelligence; the synthetical parts deal with the phenomena of intelligence objectively, and so include not human intelligence only, but intelligence under every form.

The General Synthesis, setting out with an abstract statement of the relation subsisting between every living organism and the external world, and arguing that all vital actions whatever, mental and bodily, must be expressible in terms of this relation; proceeds to formulate, in such terms, the successive phases of progressing Life, considered apart from our conventional classifications of them.

And the Special Synthesis, after exhibiting that gradual differentiation of the psychical from the physical life which accompanies the evolution of Life in general, goes on to develop, in its application to psychical life in particular, the doctrine which the previous part sets forth: describing the nature and genesis of the different modes of Intelligence, in terms of the relation which obtains between inner and outer phenomena.

As may be supposed, the analytical divisions are much less readable than the synthetical ones. Hence, while all who are accustomed to studies of an abstract character are recommended to follow the order in which the parts stand, as being that most conducive to a clear understanding of the system in its ensemble; those who are unfamiliar with mental philosophy may, perhaps, more advantageously begin with Parts III. and IV: returning to Parts I. and II. should they feel sufficiently interested to do so.

Respecting the execution of the work, I may say that in sundry ways it falls much short of my wishes. There are places in which the argument is incompletely carried out; places in which, from inadequate explanation, there is an apparent incongruity between the statements there made and those

made elsewhere; and there are, I fear, places where the form of expression is not so precise as it should be. Add to which, that in treating under several separate aspects a subject so extensive, I have perhaps erred in attempting too much; and have so devoted neither thought enough nor space enough to any one of the several aspects under which the subject is presented.

While, however, I am conscious that the work contains many more imperfections than it would have done had its scope been more limited and its elaboration longer, I would excuse the issue of it in its present form on several grounds: partly on the ground that it is almost useless to wait until any organized body of thought has reached its full development, which it never does in the course of a single life; partly on the ground that it is next to impossible for the writer of a work like this, to dispense with the aid of candid criticism; but chiefly on the ground that the general truths enunciated, being, as I believe, both new and important, it seemed to me undesirable to delay their publication with the view of by and by presenting them in a more finished guise.

For the somewhat abrupt termination of the work, my apology must be, that disturbed health has obliged me to desist from writing a "Summary and Conclusion," in which I purposed to bring the several lines of argument to a focus. I greatly regret this; not only because the harmony that may be shown to subsist between the doctrines elaborated in the respective divisions, is a strong confirmation of their truth; but because, in the absence of explanation, some misunderstanding may arise concerning the implications—ontological and other—which many will think manifest.

It may be well further to say, that, originally, I had intended to add a fifth division, which should include sundry

deductions and speculations that could not properly be embodied in the other divisions. But before being compelled to do so, I had decided, that as this fifth division was not strictly necessary; and as certain of the suggestions contained in it might prejudice some against the doctrines developed in the others; it would be better to withhold it—at any rate for the present.

July, 1855.

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PART I.

GENERAL ANALYSIS.

CHAPTER I.

A DATUM WANTED.

§ 1. The postulates and axioms prefacing our expositions of exact science—our works on Geometry and our Mechanical Treatises—are received on the direct warrant of consciousness that they are indisputable. Similarly with all that we regard as objective truths; whether known immediately by simple intuitions, or mediately by the series of intuitions constituting a deductive argument. But when from objective truths we pass to subjective ones—when from the outer phenomena cognized, we turn to the inner phenomena presented by the act of cognition—when, after analysing *knowledge*, we begin to analyse *that which knows*, we are met by the question—What is here our test of validity? Consciousness vouches for the truth of propositions concerning external relations; but what shall vouch for the truth of propositions concerning those internal relations which constitute the phenomena of consciousness? To reply broadly that consciousness must be its own surety, involves the awkward corollary that all conclusions reached by self-analysis are true; seeing that in the individual who draws them, all such conclusions are dicta of consciousness. This corollary is manifestly inadmissible. It is clear that of such dicta, only some are true; and hence the need for a test by which these may be distinguished from the false. Unaided internal perception can no more suffice to build up a science of mind than unaided external perception can suffice to build up a science of things. As we cannot by a simple outward inspection determine with certainty the relation between two magnitudes, so we cannot by a simple inward inspection determine with certainty the relation between two states of

consciousness. In the one case, as in the other, some method of verifying our empirical cognitions must be found, before any sure results can be reached. True, we cannot transcend consciousness: but we can proceed in the ascertainment of internal truths, as we proceed in the ascertainment of external ones—we can make a particular mode of perception the guarantee of all other modes. And this is obviously what we must do. Some canon of normal thinking must be found, by their congruity or incongruity with which all conclusions respecting the phenomena of consciousness may be judged. If Psychology is ever to become anything more than a mere aggregation of opinions, it can only be by the establishment of some datum universally agreed to.

Especially shall we recognize this necessity, on contemplating those logical processes, required alike for the demonstration of subjective and objective truths. What is our warrant for the various acts of thought which these involve? The validity of the conclusions we draw respecting either internal or external phenomena, depends on the validity of the successive steps through which we reach them. What is our test of this validity? That some test exists, is manifest from the fact that we reject many conclusions as worthless, from the erroneousness of the steps by which they are reached. And if there is a test, then our first care must be, having definitely identified it, to examine its nature and trustworthiness. Clearly as the chains of reasoning by which all the special conclusions of Psychology must be established, are themselves psychological operations; and as the truth of such conclusions must depend upon the right conduct of these operations; it behoves us first to inquire by what method the right conduct of these operations is to be determined. On the goodness of our criterion hinges alike our logic and all the results of our logic. Rational Psychology, therefore, must necessarily take this criterion for its starting point.

Hence the need for such General Analysis of our cognitions as shall disclose the basis of certitude common to them all.

Before inquiring into the special nature of each class of cognitions, we must examine the primordial data out of which the whole of them are built. This is a needful prerequisite both for substantiating such cognitions objectively considered, and for substantiating those subjective cognitions involved in our analyses. The various external and internal intuitions which underlie the entire of our developed intelligence, and which, specifically unlike as they are, are alike in the unhesitating credence we give them, must one and all have the same guarantee. What is that guarantee?

§ 2. Even neglecting *à priori* considerations, the need for this preliminary inquiry is abundantly proved by the utter confusion of current opinion on all fundamental questions. The inability to come to any agreement respecting the first principles of things, affords in itself ample ground for thinking that there exists some yet unestablished datum of human knowledge, which must be found before the endless disputes can be brought to an end. That men should have constructed so many systems of thought which we hold to be irrational, yet cannot satisfactorily refute, is strong ground for suspecting that there is some law of normal thought which, though instinctively acted upon, is not entered among our logical canons. The possibility of defending theories so utterly at variance with universal belief as Idealism and Scepticism, and the doctrines of Fichte and Hegel, implies one of two things: either that there is some fundamental flaw in the modes of argument pursued, or that reason necessarily leads to unreasonable conclusions. Can there be any doubt which of these is the more probable? It is much easier to suppose that particular thinkings are incidentally fallacious, than that all thinking is essentially fallacious.

The fact that even in those who draw these incongruous inferences the intellect unceasingly protests against them, would alone be good ground for assuming that its laws have been broken. The "natural propensity," as Hume styles it, to take

a realist view of things, is one which no man ever rid himself of by proving Realism logically false. When we remember that in all other cases valid deductions eventually become beliefs—that though erroneous preconceptions may for a time shut the door on them, yet increasing knowledge by and by reverses this proceeding—when we remember this, it seems more likely that the incredible deductions of metaphysicians should be vicious than that they should form the only exceptions.

Regard the philosopher objectively. Is it not clear that the faculties he is now employing in reasoning about consciousness and ideas, are the same faculties with which in childhood he drew his simplest inferences? Must not the action of these faculties follow, throughout, the same law? Must not the results of their action be therefore congruous? And when they are not congruous, does not the fact indicate something abnormal—some nonconformity with the laws of their action—some error, as we say?

Indeed, on looking at the matter in the abstract, the logical impossibility of these theories that conflict with universal belief becomes manifest. For clearly, unless we can transcend consciousness, all metaphysics can be nothing but an analysis of our knowledge by means of our knowledge—an inquiry by our intelligence into the decisions of our intelligence. We cannot carry on such an inquiry without taking for granted the trustworthiness of our intelligence. How then can we legitimately end in proving something at variance with our primary beliefs, and so proving our intelligence fundamentally untrustworthy? Intelligence cannot prove its own invalidity because it must postulate its own validity in doing this.

There seems ample ground, then, for thinking that some logical vice underlies the incredible conclusions which metaphysicians arrive at—a vice manifestly both deep-seated and prevalent. The facts indicate a non-recognition of some primordial element in our knowledge; and further show how all-essential is the identification of it.

§ 3. But the need for a datum is most clearly seen on contemplating the efforts made to overthrow these unnatural systems. Such efforts fail from not having as a fulcrum some universally admitted truth underlying all others. Right as Reid may have been in his conviction, he cannot be said to have demonstrated that he was so. His "Inquiry into the Human Mind" contains no disproof of Scepticism, but is little more than an elaborate protest against it. Whilst now and again raising the hope that he is about to expose some fundamental error in his opponent's argument, he constantly disappoints by ending with another emphatic condemnation of the conclusion it leads to. "An absurdity too gross to merit confutation"—" palpable absurdities" which "with the adepts pass for profound discoveries"—"to reason against any of these kinds of evidence (of the senses, memory, &c.) is absurd" —such are the expressions with which he commonly winds up a paragraph; expressions that fall harmlessly on the sceptic who admits the seeming ridiculousness of his inferences, but asks how they can be untrue if logically drawn. In his later work, the "Essays on the Intellectual Powers of Man," Reid still beats the air. He continues to assume all that Scepticism calls in question. In the chapter on "Principles taken for granted," he says:—"I perceive figure, colour, hardness, softness, motion, resistance, and such like things. But these are qualities, and must necessarily be in something that is figured, coloured, hard or soft, that moves or resists. . . . . We do not give the name of mind to thought, reason, or desire; but to that being which thinks, which reasons, which desires." Thus he adopts as premisses what Hume rejects as conclusions. He finds no common ground on which he and the doubter alike stand, and standing on which they may try their strength; but having thrown down his gage, he remains outside the lists, and merely hurls at his opponent an occasional sarcasm. Regarded as contributions to Psychology, his "Essays" have merit; but as constituting an answer to Scepticism, they have none.

In the Dissertation appended to his edition of Reid's works, Sir William Hamilton places the Common-sense Philosophy on a more satisfactory footing. But though by the systematic coherence he gives to its doctrines, he makes it look more tenable, he does not render it criticism-proof. Unfortunately, some of his main positions are open to objection. Among the self-evident propositions with which he sets out, are these :—

"Consciousness is to be presumed trustworthy until proved mendacious."

"The mendacity of consciousness is proved, if its data, immediately in themselves, or mediately in their necessary consequences, be shown to stand in mutual contradiction."

Now a sceptic might very properly argue that this test is worthless. For as the steps by which consciousness is to be proved mendacious are themselves states of consciousness; and as they must be assumed trustworthy in the act of proving that consciousness is not so; the process results in assuming the trustworthiness of particular states of consciousness, to prove the mendacity of consciousness in general. Or to apply the test specifically—Let it be shown that two data of consciousness stand in contradiction. Then consciousness is mendacious. But if consciousness is mendacious, then the consciousness of this contradiction is mendacious. Then consciousness is trustworthy. And so on for ever.

If it be replied that, could it be shown, a contradiction between the data of consciousness would still be the justification of scepticism—that though it would not prove the certainty of falsehood, which implies somewhere a test of truth, it would yet prove the impossibility of determining that any judgment whatever was either true or false; the rejoinder is, that the cognition of a contradiction between two primary data of consciousness, implying as it does the union of those two data in a certain relation, is a more complex operation of consciousness than the cognition of either datum by itself; that any untrustworthiness of consciousness, did it exist, must render the compound cognition much more uncertain than the simple

ones; that hence the consciousness of a contradiction can never have so great a validity as either of the primary data of consciousness between which it is supposed to exist; that thus the only logical scepticism must be directed against the seeming contradiction; and that, consequently, scepticism must destroy itself at the first step.

Doubtless all this, merely serving to show, as it does, that the mendacity of consciousness cannot be proved, and that the effort to establish, by any mental act whatever, either the validity or invalidity of consciousness, is analogous to the mechanical absurdity of trying to lift the chair one sits on, does not diminish the credibility of consciousness—merely shows that its credibility must be assumed. Sir William Hamilton's test simply fails to help us; the only harm being that the offer of a valueless guarantee lays open to cavil that which it is put forward to insure.

A much more serious objection, however, may be raised to the proposition, on which turns the whole defence of Common Sense *versus* Scepticism. Sir William Hamilton says:—"In the act of sensible perception I am conscious of two things;—of *myself* as the *perceiving subject*, and of an external reality in relation to my sense as the *object perceived.* * * * * Each of these is apprehended equally and at once *in the same indivisible energy;*" or, as he elsewhere phrases it—"*in the same indivisible moment of intuition.*"

Now this alleged simultaneity in our consciousness of subject and object, on which Sir William Hamilton relies for his proof of Realism, will not only be disputed by many as not being uniformly confirmed by their experience, but there would be no sufficient warrant for his conclusions, did experience invariably endorse his premiss. At a future stage of the argument, I propose to adduce evidence countenancing the belief, that in the act of perception our consciousness of subject and object is *not* simultaneous; but even were there no such evidence, this *apparent* simultaneity would be inadequate proof of *real* simultaneity.

For it must be remembered, that states of consciousness which originally occurred in distinct succession do, by constant association, come to follow one another so rapidly as to seem inseparable; and that in virtue of this law we ultimately unite a whole group of perceptions so instantaneously, that they appear as one perception. On looking at a book, we seem to take in all its leading properties "in the same indivisible energy." We cannot detect any lapse of time between our recognition of the book as a whole and our recognition of the parts we see: yet it is universally admitted, that the unseen sides of the book are *inferred* from the seen sides. We cannot detect any lapse of time between our recognition of the solidity of the book and our recognition of its colour and extension: yet it is universally admitted, that the solidity is *inferred* from these. And as all inferred ideas must come after those from which they are inferred, it is clear that we do not recognize the various properties of the book simultaneously, though we seem to do so. Were apparent simultaneity in the acts of consciousness a proof of real simultaneity, nothing would be clearer than that we perceive an object and its distance from us "in the same indivisible moment of intuition;" for it is impossible to distinguish any interval between these perceptions. Yet no fact in Psychology is better established than this,—that the perception of a thing's distance is *subsequent* to the perception of the thing itself—is a *deduction* from the mode in which the thing affects us; and that the apparent simultaneity is in truth a succession too rapid for detection.

Hence, as there is no obvious reason why the apparent simultaneity in our consciousness of subject and object may not be of like nature, the position that subject and object are apprehended "in the same indivisible moment of intuition," cannot be considered unquestionable; and is consequently not a fit basis for the refutation of Scepticism.

§ 4. The only further considerations of moment touching this required first principle—considerations indicating the direc-

tion in which it should be looked for—are suggested by the "*Cogito ergo sum*" which Descartes took for the foundation of his system. Passing over all criticisms, on the assumption that the proposition *I think* is more certain than the proposition *I am*—even granting that this last truth can become positively known only as a corollary from the first, there yet remains the fatal question—What gives validity to the *therefore?* Something more than the two states of consciousness, *I think* and *I am*, is involved; namely, the state of consciousness in which the relation of the one to the other is established. The absolute truth of the premiss being admitted, it is clear that before absolute truth can be claimed for the conclusion, it must be proved to be absolutely true that the one involves the other. Surely this needs verification quite as much as the proposition, *I am:*—nay more; seeing that the cognition of the dependence of one thing upon another is more complex, and therefore more uncertain, than the cognition of either thing by itself.

Is it not then obvious that the first thing to be investigated is that mental act whereby we recognize the validity of our convictions? The fact of choosing for a basis some such fundamental proposition as *I think*, in preference to the countless other possible propositions, implies that there exists a process of thought by which the relative trustworthiness of propositions is ascertained—by which we class some convictions as less questionable than others, and some as unquestionable. And similarly the fact of choosing a particular conclusion as following from the premisses rather than any other, implies a process of thought by which we distinguish a valid logical act from invalid ones. In either case, we believe one thing rather than some other thing. And the all-essential question arising alike in these cases, and in every case, is—why? Ignoring, as is requisite in a fundamental analysis, the conventional distinction between knowing and believing, and considering, as we must, our whole knowledge to be made up of beliefs, the ground-problem is, to determine the

nature of a true belief. Our starting point must be, *not any substantive proposition believed, but some canon of belief itself.* Here only can be found the fact which underlies all other facts.

These abstract reasons for seeking the required datum in a law of correct credence, suggest a definite course of investigation. Commencing it, as seems desirable, with a somewhat different and more specific statement of the preliminary position just indicated, we shall presently find ourselves led to the desired result.

CHAPTER II.

THE UNIVERSAL POSTULATE.

§ 5. When we try to reduce the genesis of our knowledge to scientific ordination, and when to this end we search for the fundamental fact—the fact on which all knowledge depends—we meet the difficulty that there are several facts apparently answering to this description. Personal existence, the existence of ideas, of consciousness, of beliefs—these look equally primordial. Each seems to presuppose one or more of the others; and yet each in turn may be assigned with some plausibility as the basis of the others. Personal existence may be held the most certain fact of all. Yet it may be argued, that personal existence is merely a belief; and that the existence of beliefs is, therefore, more certain than personal existence. To which again there is the reply that a belief implies something believed; and that this something believed must be antecedent to, and more certain than, the belief. All things are resolvable into ideas, is another position for which much may be said. But this position is liable to the criticism that ideas presuppose something to take cognizance of them—a consciousness; and that, all ideas being states of consciousness, the existence of consciousness must be prior to the existence of ideas. In rejoinder to which it is urged, that we become conscious only by the reception of ideas; and hence that there must be an idea before there can be consciousness. If it be said that ideas and consciousness must be classed amongst beliefs—that we have no other proof of their existence than that we believe them to exist—there comes the answer that beliefs are themselves ideas or states of consciousness; and this again may be met by saying that the conclusion that beliefs are states of consci-

ousness is itself a belief. Thus we are driven from one position to another, only that we may relinquish that for a third; until there appears no alternative but to assume these facts to be equally fundamental—to lie on the same plane, either as mutually dependent facts, or as different aspects of the same fact.

On carefully reconsidering the matter, however, we may perceive that be the genesis of these facts simultaneous or successive, and if successive whatever be the order, there is still one of them which being unavoidably taken for granted, in every process of thought, must necessarily have priority of the others; namely, *belief*. Every logical act of the intellect is a predication—is an assertion that something *is*; and this is what we call belief. Each major premiss is a belief; each minor premiss is a belief; each conclusion is a belief. An argument is a series of dependent beliefs. Hence all connected thought being made up of beliefs, it is clear that be the propositions it embodies what they may—be they even the existence of consciousness, of ideas, of personality—they must be less certain than the existence of beliefs.

Or to state the matter in another form — Belief is the recognition of existence—is a knowing of the existent from the non-existent. All our reasoning is a distinguishing of truth from error—of that which exists from that which does not. Consequently upon the reality of the distinction we make between that which is, and that which is not; or, in other words—on the reality of belief; depends the possibility of reasoning. We may deny all other things, and yet leave our logical forms intact. But deny beliefs, and not only do the things about which we argue disappear; argument itself disappears. Now the thing which being abolished carries everything else with it must be the fundamental thing.

It may seem very clear that in order of genesis, belief is not primary but secondary. It may be plausibly urged that it is a particular state of the *ego*, and must therefore exist subsequently to the *ego*; or that it is a complex idea, dependent

upon, and arising out of, simple ideas; or that it is not an idea at all, but a peculiarity in certain of our ideas. But cogent as may be the arguments brought in support of these propositions, they cannot touch the conclusion above drawn. For each of these propositions is itself a belief; and each of the reasons given in proof of it is a belief. Dig down as deep as we may, we can never get to anything beyond beliefs; seeing that the deepest thing we reach becomes a belief at the moment of its disclosure, and for logical purposes can never be anything else. Let it be granted, for argument's sake, that all our beliefs are predications concerning pre-existing things—sensations, ideas, consciousness; let it be granted that until these exist there can be no predications about them,—no beliefs; let it be granted, that in reasoning or in forming beliefs, we, as it were, look down upon these sensations and ideas, and observe certain of their properties, which we could not do unless they were previously there—let all this be granted: it nevertheless remains true, that as the reasoning faculty can deal with no facts until they are cognized by it—as until they are cognized by it they are to it non-existent—it follows that in being cognized, that is, in becoming beliefs, they begin to exist relatively to our reason. Whether really pre-existent or not they can have no logical pre-existence; since the being perceived to exist is the being believed.

Hence, belief is the fact which, to our intellects, is antecedent to, and inclusive of, all other facts. It is the form in which every fact must present itself to us, and therefore underlies every fact. It alone of all things cannot be denied without direct self-contradiction. The propositions—there is no consciousness, there are no ideas, there is no personal identity, may be absurd; but they are not immediately self-destructive. To say, however—there is no belief, is to utter a belief which denies itself—is to draw a distinction between that which is, and that which is not, and at the same time to say that we do not distinguish between that which is, and that which is not.

Belief, then, being the ultimate fact which we can never transcend, there next come the questions—How do we class our beliefs? Why do we consider certain of our beliefs more trustworthy than others? What is the peculiarity of those beliefs which we never question, and to which all the rest of our beliefs defer?

To give any psychological answer—to discuss Hume's theory of belief or any other, would be beside the argument. No concrete analysis of belief is possible without taking for granted ideas, or consciousness, or personal identity; and to do this would be to involve in our desired test of credibility some of the cognitions which are to be tested by it. At present our assumptions are limited to three—existence, its correlative non-existence, and a cognition of the difference, that is —belief. The problem is to find a canon of belief without assuming anything further. For if, in classing our beliefs according to their degrees of validity, some fourth thing should be taken for granted, the existence of such degrees of validity could have no greater certainty than the existence of this fourth thing.

Existence, non-existence, and belief, being thus the terms to which we are confined, there is clearly no alternative but to define different kinds of belief by qualities expressible in the other two terms. At first sight this appears hopeless; for whilst there can be existent beliefs, there cannot be non-existent beliefs. But though it seems paradoxical to say so, we may, by the union of the two terms existence and non-existence, obtain a third which describes the nature of some of our beliefs as contrasted with others. Here at least is the only possible classification—that into beliefs of which existence alone can be predicated, and beliefs of which partly existence and partly non-existence can be predicated—beliefs that *invariably exist,* and beliefs that *do not invariably exist.* That this division really corresponds with our experience scarcely needs saying. All know that, on the one hand, they have beliefs which are constant and which no mental effort can for

a moment rid them of; whilst on the other they have beliefs which are not only changed by evidence, but which can be temporarily suppressed by the imagination.

To say that as a corollary from this, the invariable existence of a belief is our final test of certainty—to say that where there are conflicting propositions, one of which corresponds to an invariably existent belief, whilst the other does not, we must adopt the one that so corresponds, is needless—is in fact a truism. For an invariably existent belief is, by virtue of its being one, incapable of being replaced by any other. It is not that we *ought* to adopt that belief, but that we can do nothing else. In saying that it is invariably existent we say that there is no alternative belief.

That its invariable existence is the ultimate guarantee assignable for any belief, is, indeed, a conclusion which may be otherwise arrived at. For when we assign for any belief, a deeper belief on which it rests—when as warrant for some belief A, we cite some fundamental belief B which involves it, and say that we hold the belief A because it is implied in the belief B, it is manifest that the validity of the warrant depends upon the validity of the belief that B *does* involve A; and for this belief we have no other reason to assign but that it exists. So that supposing we knew the belief B to possess *absolute* truth, it could never give to the consequent belief A any higher guarantee than this of invariable existence; seeing that we can produce no higher guarantee for our belief that the one involves the other.

Or perhaps the fact may be more clearly shown thus:—If we assign as a reason for any belief the belief on which it rests, and then assign for that belief an anterior one, and so on continuously, it is clear that we must eventually come to the end of the series—must arrive at some primordial belief of which no proof can be given. This remains true, whatever theory we hold respecting the origin of our knowledge. For if we say that all knowledge is organized experience, and that,

in assigning one belief in proof of another, we are simply assigning a wider experience in proof of a narrower, it is clear that we cannot continue to assign wider and wider experiences in proof of each other, without arriving finally at the widest. As our experience had a beginning, it follows that, in tracing it backwards, we must ultimately come to our first or deepest experience—an experience which has no other to rest upon. Similarly with the hypothesis of fundamental ideas. An analytical examination of beliefs must eventually bring us down to these; and for these the hypothesis itself implies that no reason is assignable. Hence, whether our lowest beliefs be innate or derived from experience, it is equally clear that, as they do not admit of proof, we can but say that they invariably exist. And whilst this fact of their invariable existence is alone our warrant for them, it at the same time expresses the necessity we are under of holding them.

It results, then, from all that has been said,—first, that the existence of beliefs is the fundamental fact; and second, that beliefs which invariably exist are those which, both rationally and of necessity, we must adopt.

§ 6. For the further development of these conclusions into the specific datum we are in search of, another element is needful; and I cannot more conveniently bring this into view than by some comments upon the controversy that has lately been carried on respecting the nature and origin of necessary truths.

In his "Philosophy of the Inductive Sciences," Dr. Whewell defines necessary truths as "those in which we not only learn that the proposition *is* true, but see that it *must be* true; in which the negation of the truth is not only false, but impossible; in which we cannot, even by an effort of imagination, or in a supposition, conceive the reverse of that which is asserted." Or, to quote the abridged form to which Mr.

Mill, in his criticism, reduces it—"A necessary truth is a proposition the negation of which is not only false but inconceivable."

The first thing to be said of this definition is, that it includes many other truths than those called "necessary." His personal existence is a truth which every man can cite this warrant for. To his consciousness it is a truth of which the negation is inconceivable. That he *might* not exist he can conceive well enough; but that he *does* not exist he finds it impossible to conceive. The pain felt on plunging the hand into scalding water, is a pain which the sufferer cannot, "by an effort of imagination," conceive non-existent. Were the existence of the pain a truth of which the negation was conceivable, he would quickly conceive the negation, and thus rid himself of the pain. But so convenient a mode of obtaining relief, the sufferer finds, to his cost, impracticable. Unless, therefore, the propositions—"I exist," "I feel pain," and others like them, be classed as necessary truths, the definition will not hold. Doubtless there is a wide difference between the universal truths which Dr. Whewell has in view, and the particular truths here instanced; but the difference is not that implied in his definition.

This fact, that the truths of immediate perception have the same warrant as the so-called necessary truths, is quite in harmony with, and, indeed, serves to confirm, the arguments which Mr. Mill brings forward to disprove the alleged *à priori* character of these necessary truths. But whilst agreeing with him in the belief that axioms are simply "our earliest inductions from experience," it is possible to differ from him widely as to the worth of the test of inconceivableness. In attacking the theory I think he has needlessly undervalued the witness. He says:—

"I cannot but wonder that so much stress should be laid on the circumstance of inconceivableness, when there is ample experience to show that our capacity or incapacity of conceiving a thing has very little to do with the possibility of the

thing in itself; but is, in truth, very much an affair of accident, and depends on the past history and habits of our own minds. . . . . When we have often seen and thought of two things together, and have never, in any one instance, either seen or thought of them separately, there is, by the primary law of association, an increasing difficulty, which may, in the end, become insuperable, of conceiving the two things apart. . . . . There are remarkable instances of this in the history of science: instances in which the most instructed men rejected as impossible, because inconceivable, things which their posterity, by earlier practice and longer perseverance in the attempt, found it quite easy to conceive, and which everybody now knows to be true."—"System of Logic," pp. 265, 266.

And he then proceeds to give sundry illustrations showing this dependence of conceivability upon experience—illustrations, however, which, as will hereafter be shown, are not altogether unobjectionable.

Granting, nevertheless, that the evidence assigned affords sufficient disproof of the doctrine that truths of which the negation is inconceivable are *à priori*, it does not really warrant Mr. Mill's inference that it is absurd "to reject a proposition as impossible on no other ground than its inconceivableness;" however much it may seem to warrant him. For the facts cited simply go to show that men have mistaken for inconceivable things, some things which were not inconceivable —a species of error which, if it vitiates the test of inconceivableness, must similarly vitiate all tests whatever. We consider an inference logically drawn from established premisses to be true. Yet, in millions of cases, men have been wrong in the inferences they have thought thus drawn. Do we, therefore, argue that it is absurd to consider an inference true "on no other ground" than that it is logically drawn from established premisses? No; we say that though men may have taken for logical inferences, inferences that were not logical, there nevertheless *are* logical inferences, and that we

are justified in assuming the truth of what seem to us such, until better instructed. Similarly, though men may have thought some things inconceivable which were not so, there may still be inconceivable things; and the inability to conceive the negation of a thing, may still be our best warrant for believing it.

Conceding the entire truth of Mr. Mill's position, that, during any phase of human progress, the ability or inability to form a specific conception wholly depends on the experiences men have had; and that, by a widening of their experiences, they may, by and by, be enabled to conceive things before inconceivable to them; it may still be argued that as, at any time, the best warrant men can have for a belief is the perfect agreement of all pre-existing experience in support of it, it follows that, at any time, the inconceivableness of its negation is the deepest test any belief admits of. Though occasionally it may prove an imperfect test, yet, as our most certain beliefs are capable of no better, to doubt any one belief because we have no higher guarantee for it, is really to doubt all beliefs.

Or to state the case in another form—If all our knowledge is derived from experience, then our notions of *possible* and *impossible* are derived from experience. Possible means—not at variance with our experience; impossible means—wholly at variance with our experience. Clearly, unless we possess fundamental ideas, or can gain a knowledge of things in themselves, no logical process can give to the notion, *impossible*, any larger meaning than this. But if, at any time, the inability of men to conceive the negation of a given proposition simply proves that their experience, up to that time, has, without exception, confirmed such proposition; then when they assert that its untruth is impossible, they really assert no more than when they assert that its negation is inconceivable. If, subsequently, it turn out that the proposition *is* untrue; and if it be therefore argued that men should not have held its untruth impossible because inconceivable, I reply, that to say

this, is to condemn the use of the word impossible altogether. If the inconceivability of a thing be considered insufficient warrant for asserting its impossibility, it is implied that there can exist a sufficient warrant; but such warrant, whatever its kind, must be originally derived from experience; and if further experience may invalidate the warrant of inconceivableness, further experience may invalidate *any* warrant on which we assert impossibility. Therefore, we should call nothing impossible.

It is, indeed, surprising that so acute a critic as Mr. Mill should not have seen that his own analysis supplies the best justification of this test of inconceivableness. What is the object of any such test? To insure a correspondence between subjective beliefs and objective facts. Well, objective facts are ever impressing themselves upon us; our experience is a register of these objective facts; and the inconceivableness of a thing implies that it is wholly at variance with the register. Even were this all, it is not clear how, if every truth is primarily inductive, any better test of truth could exist. But it must be remembered that whilst many of these facts, impressing themselves upon us, are occasional; whilst others again are very general; some are universal and unchanging. These universal and unchanging facts are, by the hypothesis, certain to establish beliefs of which the negations are inconceivable; whilst the others are not certain to do this; and if they do, subsequent facts will reverse their action. Hence if, after an immense accumulation of experiences, there remain beliefs of which the negations are still inconceivable, most, if not all of them, must correspond to universal objective facts. If there be, as Mr. Mill holds, certain absolute uniformities in nature; if these uniformities produce, as they must, absolute uniformities in our experience; and if, as he shows, these absolute uniformities in our experience disable us from conceiving the negations of them; then answering to each absolute uniformity in nature which we can cognize, there must exist in us a belief of which the negation is inconceivable,

and which is absolutely true. In this wide range of cases subjective inconceivableness must correspond to objective impossibility. Further experience will produce correspondence where it may not yet exist; and we may expect the correspondence to become ultimately complete. In nearly all cases this test of inconceivableness must be valid now; and where it is not, it still expresses the net result of our experience up to the present time; which is the most that any test can do.*

But the inconsistency into which Mr. Mill has thus fallen, is most clearly seen in the second of his two chapters on "Demonstration and Necessary Truths."

He admits in this, the validity of proof by a *reductio ad absurdum*. Now what is a *reductio ad absurdum* unless a reduction to inconceivableness? And why, if inconceivableness be in other cases an insufficient ground for rejecting a proposition as impossible, is it a sufficient ground in this case?

Again, calling in question the necessity commonly ascribed to the deductive sciences, he says:—

"The results of these sciences are indeed necessary, in the sense of necessarily following from certain first principles, called axioms and definitions; of being certainly true, if these axioms and definitions are so. But their claim to the character of necessity in any sense beyond this . . . . . must depend on the previous establishment of such a claim in favour of the definitions and axioms themselves."—Chapter vi.

Or, as he previously expresses the same view:—

"The only sense in which necessity can be ascribed to the conclusions of any scientific investigation, is that of necessarily

* To prevent misconception it may be well to remark that, though here apparently committing myself to the experience-hypothesis in its entirety, I do not hold it in its current acceptation, any more than I so hold the antagonist hypothesis of forms of thought, which, nevertheless, contains a truth. In a future stage of the inquiry I hope to show that both these hypotheses are right in a limited sense, and both wrong in a limited sense; that they admit of reconciliation; and that the truth is expressed by their union.

following from some assumption which, by the conditions of the inquiry, is not to be questioned."—Chapter v.

Here, and throughout the whole of his argument, Mr. Mill assumes that there is something more certain in a demonstration than in anything else—some necessary truth in the steps of our reasoning, which is not possessed by the axioms they start from. How can this assumption be justified? In each successive syllogism the dependence of the conclusion upon its premisses is a truth of which we have no other proof than the inconceivability of the negation. Unless our perception of logical truth is *à priori*, which Mr. Mill will not contend, it too, like our perceptions of mathematical truth, has been gained from experience. In the one case, as in the other, we have simply an induction, with which no fact has, to our knowledge, ever conflicted. And if this be an insufficient warrant for asserting the necessity of the one order of truth, it is an insufficient warrant for asserting the necessity of the other.

How complete is the parallelism may indeed be best proved from Mr. Mill's own admissions. In an earlier chapter he has endeavoured to show that by analysis of the syllogism we arrive at "a fundamental principle, or rather two principles, *strikingly resembling the axioms of mathematics*. The first, which is the principle of affirmative syllogisms, is, that things which coexist with the same thing, coexist with one another. The second is the principle of negative syllogisms, and is to this effect: that a thing which coexists with another thing, with which other a third thing does not coexist, is not coexistent with that third thing." Elsewhere, if I remember rightly, he points out the remarkable analogy between this logical axiom —things which coexist with the same thing, coexist with one another—and the mathematical axiom—things which are equal to the same thing are equal to one another. Analogous, however, as they are, and similarly derived as they must be, Mr. Mill claims for the first a necessity which he denies to the last. When, as above, he asserts that the deductive sciences

are not necessary, save "in the sense of *necessarily following* from certain first principles called axioms and definitions, of being *certainly* true *if* those axioms and definitions are so"—he assumes that whilst the mathematical axioms possess only hypothetical truth, this logical axiom involved in every step of the demonstration possesses absolute truth—that whilst the inconceivability of its negation is an imperfect guarantee for the one, it is a perfect guarantee for the other. Evidently this is an untenable position. Unless it can be shown that this truth—things which coexist with the same thing coexist with each other—has some higher warrant than the inconceivability of its negation (which cannot be shown), it must be admitted that axioms and demonstration stand on the same footing; that if necessity be denied to the one, it must be denied to the other, and, indeed, to all things whatever.

Of objections to the test of inconceivability it remains but to notice the one pointed out by Sir William Hamilton in his edition of Reid (p. 377). In proof that inconceivability is not a criterion of impossibility, he cites the fact, that "we can neither conceive, on the one hand, an ultimate minimum of space or time; nor can we, on the other, conceive their infinite divisibility. In like manner, we cannot conceive the absolute commencement of time, nor the utmost limit of space, and are yet equally unable to conceive them without any commencement or limit." The implication being, that as there must be either minimum or no minimum, limit or no limit, one of the two inconceivable things must in each case be true. Exception might be taken to this argument on several grounds—on the ground that space and time in the abstract, are not strictly conceivable things at all in the sense that other things are: on the ground that the alleged inconceivableness of a minimum or a limit is not really of the same nature as those with which it is classed—is not due to an arrest of the conceptive power, but a baffling of it—is not an inability to put one conception in place of another, but an inability to form any conception. Moreover, it might be urged that there is no true parallelism

between these cases in which both alternatives are alike inconceivable, and all other cases, in which one alternative is conceivable and the other not. Passing over these points, however, and granting, as has already been granted, that conceivableness depends on experience, and that hence, in respect to all things beyond the measure of our faculties it must ever remain an inapplicable test—granting all this, we say, Sir William Hamilton's argument may still be met. He says that inconceivability is no criterion of impossibility. Why? Because, of two propositions, one of which must be true, it proves both impossible—it proves that space cannot have a limit, because a limit is inconceivable, and yet that it must have a limit, because unlimited space is inconceivable; it proves, therefore that space has a limit and has no limit, which is absurd. How absurd? Absurd, because "it is impossible for the same thing to be and not to be." But how do we *know* that it is impossible for the same thing to be and not to be? What is our criterion of *this* impossibility? Can Sir William Hamilton assign any other than this same inconceivability? If not, his argument is self-destructive; seeing that he assumes the validity of the test in proving its invalidity.

§ 7. Fully to comprehend this matter, and at the same time to advance a stage nearer the desired datum, it now only needs to recall the propositions awhile since established; namely, that the existence of beliefs is the fundamental fact, and that beliefs which invariably exist are those which both rationally and of necessity we must adopt. For when, to the fact that the invariable existence of a belief is the deepest warrant we can have for it, we add the further fact that we consider those beliefs true of which the negations are inconceivable, it becomes at once obvious that *the inconceivability of its negation is the test by which we ascertain whether a given belief invariably exists or not.*

Instinctively we recognize the truth above demonstrated, that its invariable existence is the ultimate authority for any

belief; or rather, we yield to the rigorous necessity of holding any belief that does invariably exist: the fact that it invariably exists being the obverse of the fact that there is no alternative belief. But how do we ascertain that a given belief *is* invariably existent—that we *have* no alternative belief? Evidently we can do this only by trying to make such belief non-existent—by trying to put some other belief in its place; or, in other words, *by trying to conceive the negation of it.* When, failing by any mental effort to make it disappear, even for a moment, we say that nothing else is conceivable, and that it is therefore unquestionably true, we practically say that it is true because it is a belief which invariably exists.

What we mean by this word, true—whether we express by it an assumed correspondence between some objective fact and our subjective state, or whether it really implies nothing more than the continued existence of the belief to which it is applied, it would be out of place here to inquire. At present we have to consider the contents of the intellect solely as a system of beliefs, with a view to determine their relative validity. We have seen that beliefs must be their own sureties—that an indestructible belief can have no other warrant than its indestructibility; and what we have just found is, that the inconceivableness of its negation is simply an experimental proof of its indestructibility.

It results then, that for our primary beliefs, the fact of invariable existence tested by an abortive effort to cause non-existence, is the only reason assignable. If, in justifying those of our beliefs which rest upon other beliefs, we must ultimately come down to this as the foundation of the series, it follows that all beliefs not based upon other beliefs must rest directly on this foundation. Such we find to be the case. The truths of immediate consciousness have no other warrant. For the proposition "I am," no one who utters it can find any proof but the invariable existence of his belief in it. And that he cannot for an instant displace this belief by any other—cannot conceive otherwise—is the only proof he can give of its inva-

riable existence. So, too, is it with sensations. When cold, we cannot get rid of our belief in the feeling of coldness so long as that feeling continues—cannot, while cold, conceive that we are warm. Such belief, though not invariably existent in an absolute sense, is so in a relative one: it exists as long as the sensation exists. Whilst the proposition remains true, the negation of it remains inconceivable. Hence, properly understood, the belief in a sensation has the same warrant as belief in personal existence. In each case the belief invariably exists whilst its subject-matter exists—in the sensation whilst the sensation continues; in personal existence whilst personal existence continues.

And here we may recognize the real distinction between those universal truths which Dr. Whewell has supposed to stand alone in the inconceivableness of their negations, and those particular truths which we find to have the same guarantee. It is in the prevalence of the subject-matter that the difference consists. Whilst looking at the sun a man can no more conceive that he is then looking into darkness, than he can conceive the part greater than the whole. How then does the belief—this is sunlight, differ in nature from the belief—the whole is greater than its part? Simply thus; that in the one instance the antecedents of the conviction are present only on special occasions, whilst in the other they are present on all occasions. In either case subject the mind to the required antecedents, and no belief save the appropriate one is conceivable. But whilst in the first case only a single object serves for antecedent, in the other any object, real or imagined, serves for antecedent.

Not only, however, is the invariable existence of a belief our sole warrant for every truth of immediate consciousness, and for every primary generalization of the truths of immediate consciousness—every axiom; but it is our sole warrant for every demonstration. Logic is simply a systematization of the process by which we indirectly obtain this warrant for beliefs that do not directly possess it. To gain the strongest

conviction possible respecting any complex fact, we either analytically descend from it by successive steps, each of which we unconsciously test by the inconceivableness of its negation, until we reach some axiom or truth which we have similarly tested; or we synthetically ascend from such axiom or truth by such steps. In either case we connect some isolated belief, with a belief which invariably exists, by a series of intermediate beliefs which invariably exist.

To prevent misapprehension on the part of those who have not much considered the matter, it may be well, as I have yet spoken only of beliefs which invariably exist, to contrast them with a belief which, though strong, does not invariably exist; especially as in doing this there will be an opportunity of clearing up the seeming confusion which some may have perceived in the last few pages between beliefs and conceptions —a seeming confusion which the abstract nature of the argument has hitherto forbidden me to notice.

We commonly regard the belief that the sun will rise to-morrow as a constant one. It may, however, for an interval be destroyed. We find that by an effort of imagination, as we call it, the sun may be supposed to explode, burn out, or in some way be prevented from appearing to-morrow; and during the time in which we are figuring to ourselves the non-appearance of the sun to-morrow, the belief that he will appear is non-existent. It is very true that this belief is quickly reproduced; but it is none the less true that it is temporarily annihilated. Possibly, indeed, it may be alleged that the belief is never really absent, but that it remains even whilst we are conceiving the event to be otherwise. This, however, is an illusion consequent upon our habit of using words without fully realizing their meanings, and so mistaking verbal propositions for real ones. On taking care that our thoughts duly respond to the expressions, we shall find that the belief in the sun's rising to-morrow consists in a mental representation of the occurrence of certain phenomena at a certain time. And if so, it is clear that we cannot conceive the event otherwise—

cannot represent to ourselves the non-occurrence of the phenomena, without abolishing the representation of their occurrence; that is,—without abolishing the belief. Though in common language we speak of a belief as something separate from the conception to which it relates, yet on analysis we find that we simply express by it a certain property of such conception—*its persistence.* When after given antecedents there arises a state of consciousness which we can change with very little effort, we have a weak belief; when the state of consciousness is one which we can change with difficulty, we call the belief a strong one; when it is one which we find ourselves utterly unable to change, we consider it a belief of the highest order. As then in each of these cases the belief is not a something more than the state of consciousness, but merely expresses its persistence, it follows that in no case can the state of consciousness be changed, even temporarily, without the belief becoming non-existent for a corresponding period. The belief being the persistence, the persistence cannot be destroyed without the belief being destroyed. And hence the rationale of testing the invariable existence of a belief in a given proposition by the inconceivableness of its negation; seeing that the effort to conceive the negation of the proposition is the effort to change the state of consciousness which arises after certain antecedents; and if this can be done—if the persistence of the state of consciousness can be broken—the belief is thereby proved to be not invariably existent.*

Dismissing, however, all psychological explanations, which are allowable here only as being needed to meet a psychological objection, and returning to the purely abstract view of the matter, we see—first, that belief is fundamental, and that the

* The reader must be warned against the confusion that may arise from the double sense in which the word belief is commonly employed, and in which it has been unavoidably employed here also. Men habitually express a belief *in* a thing, and at other times they call the thing believed, a belief. I have given the word two parallel meanings; using it in the one case to describe the *persistence* of a state of consciousness, and in the other *a persistent state of consciousness.* The context will, in each case, show in which sense it is to be understood.

invariable existence of a belief is our highest warrant for it; second, that we can ascertain the invariable existence of a belief only as we ascertain the invariable existence of anything else, by observing whether under any circumstances it is absent from the place in which it occurs; third, that the effort to conceive the negation of a belief is the looking in the place in which it occurs (viz., after its antecedents), and observing whether there are any occasions on which it is absent, or can be made absent; and fourth, that when we fail to find such occasions —when we perceive that the negation of the belief is inconceivable, we have all possible warrant for asserting the invariability of its existence; and, in asserting this, we express alike our logical justification of it, and the inexorable necessity we are under of holding it. Mean what we may by the word truth, we have no choice but to hold that *a belief which is proved by the inconceivableness of its negation to invariably exist, is true.* We have seen that this is the assumption on which every conclusion whatever ultimately rests. We have no other guarantee for the reality of consciousness, of sensations, of personal existence; we have no other guarantee for any axiom; we have no other guarantee for any step in a demonstration. Hence, as being taken for granted in every act of the understanding, it must be regarded as the Universal Postulate.

§ 8. An appeal to this Universal Postulate as an absolute warrant for any conviction may still, however, be objected to, on the ground that, as it has on past occasions proved an insufficient warrant, it may prove so again. Beliefs that once were shown by the inconceivableness of their negations to invariably exist, have since been found untrue. And as beliefs that now possess this character may some day share the same fate, the test is clearly not an infallible one.

There is, doubtless, force in this argument, though not so much as at first appears. As we hinted when commenting on his position, the evidence cited by Mr. Mill, to show that inconceivable things may yet be true, is not strictly applicable

evidence. There is a wide difference in nature between the cases in which the test has been found fallacious, and those in which we may regard it as trustworthy—a difference arising from the relative complexities of the conceptions involved. When, on receiving a sensation, the subject of it, finding himself unable to conceive that he is not receiving it, asserts that he is receiving it, it is clear that he deals only with one state of consciousness of which he simply recognizes the continued existence. On the other hand, those Greek philosophers referred to by Mr. Mill, who "could not credit the existence of antipodes"—who "were unable to conceive, in opposition to old association, the force of gravity acting upwards instead of downwards," and who, therefore, denied that there could be men on the other side of the earth—were dealing with many states of consciousness and with the connections between them. There entered into their proposition the concepts Earth, man, distance, position, force, and the various relations of these to each other. Evidently, then, these cases differ so widely, that what may be a legitimate test in the first, may be an illegitimate one in the second. We must distinguish between those appeals to the Universal Postulate in which the act of thought is *decomposable,* and those in which it is *undecomposable.* In proportion as the number of concepts which a proposition involves is great, and the mental transitions from concept to concept are numerous, the fallibility of the test will increase; and will do this *because the formation of the belief is separable into many steps, each of which involves the postulate.*

And here, indeed, we get hold of the clue which leads us out of this logical maze. Let it be granted, that a belief which invariably exists, though the most certain possible to us, is yet not necessarily true. Let it be granted, that either from insufficient experience, or from non-agreement between the subjective and the objective, the inconceivable and the impossible may not correspond even within our mental range. Let it be granted, that for the validity even of a single undecomposable

act of thought, the Universal Postulate is an imperfect warrant. Let all this, I say, be granted. Still, be the test fallible or not, the probability of error in any inference will increase in proportion to the number of times the truth of the test has been assumed in arriving at it. If the postulate be uniformly valid, it must yet happen that, as we are liable to mental *lapsus*, we shall occasionally think we have its warrant when we have not; and in each case the chances of our having done this will vary directly as the number of times we have claimed its warrant. If the postulate be not uniformly valid, then a further source of error is introduced, the effects of which vary in the same ratio. Hence, on either supposition, it follows that that must be the most certain conclusion, at which, starting from the postulate itself, we arrive by the fewest assumptions of the postulate.

We instinctively recognize this fact in our ordinary modes of proof. We hold it more certain that 2 and 2 make 4, than that 5 + 7 + 6 + 9 + 8 make 35. We find that every fresh assumption of the postulate involves some risk of error; and, indeed, where the calculation is extremely intricate, and the assumptions therefore extremely numerous, our experience teaches us that the probability that there has been a wrong assumption, is greater than the probability that there has not. So too in argument. We lose faith in a long series of steps, however logical they may seem, unless we can test the inference by appeal to fact—that is, *unless we can get at the inference by a single use of the postulate.*

Do we not here then discern a rigorous test of the relative validity of conflicting conclusions? Not only as judged instinctively, but as judged by a fundamental logic, *that must be the most certain conclusion which involves the postulate the fewest times.* We find that under any circumstances—whether the postulate be uniformly true or not, this must hold good. Here, therefore, we have a method of ascertaining the respective values of all cognitions.

§ 9. Having both reached a specific datum and found a specific method of employing that datum, the purpose of our General Analysis would seem to be fulfilled. Practically to complete that purpose, however, it will be needful to exhibit the chief corollaries which the Universal Postulate involves. Sundry fundamental questions have to be disposed of before any Special Analysis of mental phenomena can be entered upon. No rational Psychology can be constructed save on the basis of some acknowledged relation between thought and the subject-matter of thought—between mind and nature. No explanation whatever can be given of any act of intelligence, but what implicitly affirms or denies certain ontological propositions. Hence, unless some such propositions can be established, no superstructure of science is possible. This must remain true, whatever be the special character of the Psychology to be developed. Is it realistic? Its argument may be taken in flank by a denial of the externality of things. If it be any elaboration of Idealism, it takes for granted mind and personality, and is liable to sceptical criticism on these assumptions. And the sceptic's Psychology, having for foundation its "impressions and ideas," may be brought to a stand by the assertion that these are not things but relations.

Thus then, besides the abstract datum which our canon of belief supplies, we need, before proceeding further, certain of the concrete data which that canon of belief directly guarantees. Forthwith acting on the conclusion above reached, that those are the most unquestionable propositions at which, starting from the postulate itself, we arrive by the fewest assumptions of the postulate, our first step must be to ascertain the chief truths which *do* immediately follow from the fundamental truth. The requisite materials having been so obtained, we may proceed safely to make use of them.

Perhaps the most convenient mode of exhibiting these primary deductions, will be by a criticism on the chief metaphysical theories, as tested by the Universal Postulate. An

examination of these in their relations to this criterion—a comparison between them and the conviction to which they are opposed, as severally measured by this standard of credibility, will bring out with special distinctness the valid conclusions, by giving them the invalid ones for a foil. And we shall at the same time definitely get rid of the various vicious systems and empty speculations at present encumbering the field of investigation.

CHAPTER III.

ITS COROLLARIES.

§ 10. Without noticing the many theories of Knowledge and Nature, which older times gave birth to, the end in view will be sufficiently answered, by taking a modern sample of each leading type. Let us commence with the Idealism of Berkeley.

This, in common with kindred systems of thought, is obviously, when regarded from our present stand-point, open to the criticism that it consists of a series of dependent propositions, no one of which possesses greater certainty than the single proposition to be disproved. Not to rest in this general statement of the objection, however, let us consider its application in detail.

It is an awkward fact, that Idealism cannot state its case without assuming Realism by the way. Erase from its argument all terms implying the objective reality of things, and its argument falls to pieces. Instance, in illustration of this, a passage from the first of Berkeley's Dialogues.

"*Philonous.* Then, as to sounds, what must we think of them? Are they accidents really inherent in external bodies, or not?

"*Hylas.* That they inhere not in the sonorous bodies, is plain from hence; because a bell, struck in the exhausted receiver of an air-pump, sends forth no sound. The air, therefore, must be thought the subject of sound.

"*Phil.* What reason is there for that, Hylas?

"*Hyl.* Because, when any motion is raised in the air, we perceive a sound, greater or lesser, in proportion to the air's motion; but, without some motion in the air, we never hear any sound at all.

"*Phil.* And granting that we never hear a sound but when some motion is produced in the air, yet I do not see how you can infer, from thence, that the sound itself is in the air."

If now we demur to the many obvious assumptions of Realism which this reasoning involves, and insist on Berkeley restating it without taking for granted anything save the existence of mind and ideas, he cannot do so. Let the words that stand for objective realities be supposed to stand for our ideas of them, and the argument becomes meaningless. If it be said that these objective realities are but hypothetically assumed for the purpose of meeting an opponent, it is replied that this cannot be; for Berkeley's reasonings are, in truth, his justification of Idealism to his own mind; and if he could justify Idealism to his own mind without making these assumptions, he could show us the way. How, then, can his argument be valid? An assumption may be legitimate if the reasoning based on it, by bringing out a result congruous with known truths, prove the assumption true. But what if the reasoning prove the assumption false, whilst the very terms of the reasoning presuppose its truth? We do, indeed, in mathematics assume a certain number to be the answer to a given question, and on this assumption legitimately base an argument which, by ending in an absurdity, disproves the assumption. In such case, however, the successive steps are not rendered possible only by the truth of the number assumed; for they may be as well gone through with any other number. But if the argument ended in proving that there was no such thing as number, it would do what Berkeley's argument does—it would base upon a thing's existence the proof of its non-existence.

This reasoning in dialogue offers, indeed, great facilities for gaining a victory. When you can put into an adversary's mouth just such replies and admissions as fit your purpose, there is little difficulty in reaching the desired conclusion. Throughout the discussion, *Hylas* repeatedly assents to things which, on his opponent's own principles, he should not have assented to. Thus, shortly after the outset, *Philonous*, with

the view of proving the purely subjective character of heat, obtains from *Hylas* the admission, that an "intense degree of heat is a very great pain." He then asks—"Is your material substance a senseless being, or a being endowed with sense and perception?" To which *Hylas* replies—"It is senseless, without doubt." "It cannot, therefore, be the subject of pain," continues *Philonous*. "By no means," rejoins *Hylas*. And *Philonous* then goes on to argue, that as an intense heat is a pain, and as a pain cannot exist in a senseless material substance, it follows that an intense heat can exist only in a perceiving mind. But what right has *Hylas* to make the answers he does? The argument sets out with the position that sensible things are the only things we certainly know; these sensible things are defined as "the things we immediately perceive by the senses;" and *Philonous*, resolutely ignoring everything else, says:—"Whatever other qualities, therefore, you speak of, as distinct from these, I know nothing of them." Had *Hylas*, as he should have done, taken the same ground, the dialogue would have run thus:—

Phil. Is material substance a senseless being, or a being endowed with sense and perception?

Hyl. I cannot say.

Phil. How do you mean you cannot say?

Hyl. I mean that like you, "I know nothing" of any qualities of bodies save those I immediately perceive through the senses; and I cannot immediately perceive through the senses whether material substance is senseless or not.

Phil. But you do not doubt that it *is* senseless?

Hyl. Yes; in the same way that you doubt my external reality—doubt whether I am anything more than one of your ideas. Did we not, at the beginning, Philonous, distinguish between things known immediately and things known mediately?

Phil. Yes.

Hyl. Did you not make me admit that sensations are the only sensible things; that is, the only things immediately

perceived; and that I cannot know the causes of these sensations immediately, but can only know them mediately by reasoning?

Phil. I did.

Hyl. And your whole argument is an attempt to show that these things which I know mediately—these things, whose existence I infer as the causes of my sensations, do not exist at all.

Phil. True.

Hyl. How, then, can you put any trust in my reply, when I either say that matter is sensitive, or that it is not sensitive? The only sensitiveness that I can immediately perceive is my own.

Phil. You know that I am sensitive.

Hyl. Yes, but how? I see you turn when spoken to, and shrink when burned; from such facts, joined with my personal experiences, I *infer* that you are sensitive as I am; and if you must have an answer to your question, I *infer* that matter is not sensitive, because it shows no such signs.

Phil. Well.

Hyl. Well! do you not see that if you adopt this answer your whole reasoning is vitiated? You set out to disprove a certain portion of my mediate knowledge. To do this, you now ask from me another portion of my mediate knowledge, as you have already asked several, and will, I suppose, ask more. You are combining these many portions of mediate knowledge, and will draw from them a conclusion; and this conclusion—this piece of *doubly* mediate knowledge, you will, I suppose, offer to me in place of the mediate knowledge you would disprove. Certainly I shall reject it. I demand that every link in your argument shall consist of *immediate* knowledge. If but one of them is an inference, and not a thing "immediately perceived by sense," I shall say that your conclusion has the same uncertainty with this that you combat, plus the uncertainty attendant on all argument. Nay, indeed, were every step in your demonstration a piece of

immediate knowledge, I should argue that as the inference you drew was but mediate knowledge, it could have no greater warrant than the adverse one. As it is, however, your inference, as judged by your own principles, has incomparably less warrant.

Space permitting, it might be argued at length that Berkeley confounds the *having a sensation* with the *knowledge of having a sensation.* Unconsciously doing homage to the principle that the fewer times the Universal Postulate is assumed, the more certain is the conclusion, he professes to recognize that only which is immediately perceived—that which involves but one assumption of the postulate; and declines to recognize the mediate perceptions which involve it more than once. Yet what he starts with as primary and unquestionable facts belong to this last class. Whilst the reception of a sensation may be a simple undecomposable mental act; to observe the reception of a sensation is decidedly a composite one. The knowledge of having a sensation, so far from being an act of immediate consciousness, presupposes a much-involved process. It presupposes a synthesis of those ideas constituting the notion of personal identity; and then a recollection of how that personal identity has just been affected. Or, to state the position in another form—It is impossible for any one to know he has a sensation, without self-consciousness becoming an element of his thought. Self-consciousness, however, can never be known immediately, but only by recollection. No one can be conscious of what he *is,* but only of what he *was* a moment since. That which thinks can never be the object of direct contemplation; seeing that to be this, it must become that which is thought of, not that which thinks. It is impossible to be at the same time that which regards and that which is regarded. We never can be *literally* self-conscious, but can only know at each instant what we were the instant before; and can but *infer* present existence from the cognition of existence just past. And if self-consciousness cannot be immediate knowledge, nothing can be immediate knowledge into which self-

consciousness enters as one concept. Therefore, the knowledge of having sensations cannot be immediate knowledge. Were the consciousness of sensations the same thing as the consciousness of receiving sensations, Berkeley's first step would be unassailable. As it is, however, the assumption on which his whole argument rests, is open to the same criticism that he himself passes on the adverse assumption; namely, that it is not a perception, but a synthesis of perceptions.

But the true answer to Idealism—the answer of which the foregoing must be regarded as adumbrations—is involved in the answer to Scepticism; to which let us now turn.

§ 11. Hume's doubts as to the validity of reason, should have led him not to a state of suspense, but to an entire rejection of all his conclusions. Such a course might be proved logically necessary, even from his own point of view. Let us, however, suppose him to be in possession of the views above advanced; and then observe the course his scepticism must take.

"I doubt whether my subjective beliefs have any objective basis; that is, when I have an impression, I have no proof that there is anything external causing it; that is, though I cannot for a moment rid myself of the belief that there is something, yet there may be nothing. But how do I know that there may be nothing?"

"Reason tells me so."

"But if, when I say—'It is impossible for the same thing to be and not to be,' I say so because I have an invariably existent belief to that effect—a belief proved to invariably exist by my inability to conceive its negation; and if, when I draw a conclusion from this logical aphorism, I do so by saying that if the aphorism be true, I have a similarly indestructible belief that my deduction is true; then it follows that all my reasoning consists in concluding those things to be true in which I have an indestructible belief—a belief proved indestructible by my inability to conceive its negation."

"But I have just this kind of belief in an external world. Now that I am looking at the table, I find that by no effort, however violent, can I conceive that the table is an impression in me and not a thing outside of me. I can make a verbal proposition to that effect; but I am quite incapable of making my thoughts respond to it. Whilst looking *away* from the table, I can vaguely conceive that the fact *might be* so; but whilst looking *at* the table, I feel it utterly impossible to conceive that the fact *is* so."

"Evidently, then, my belief in the externality of things has the same warrant that every step in my argument has—is simply arrived at by *an argument of one step.*"

"Hence, to conclude that there is no proof of an external world, is to reason my way to the conclusion that reason is fallacious. But if reason be fallacious, then the reasoning by which I prove the fallacy of reason is itself fallacious. Then reason is not fallacious. Then its inferences respecting the fallacy of reason are true. And so on perpetually."

"It results, therefore, from my position, that it is impossible to decide whether reason is fallacious or not fallacious."

"Be it which it may, however, it is clear that my scepticism is not logically justifiable. If reason be not fallacious, then is the single-stepped argument which proves the existence of objects, valid. If it be fallacious, then it is manifestly impossible to shake an argument of one step by an argument of many steps."

Leaving general statements of the case, and setting ourselves to consider it fundamentally, we find that the whole question at issue resolves itself into this—Which is the more certain, the existence of objects or the existence of impressions and ideas? Possibly some of the foregoing considerations may have led the reader to suspect that Philosophy has after all given a wrong answer to this question. If so, they will have prepared the way for an examination into the relative validity of our beliefs in subjective and objective things, as tested by the number of times the Universal Postulate is

assumed in arriving at each belief respectively. And, to avoid reasoning in a circle, he will see the propriety of sweeping his mind clear of hypotheses, so that, freed from all disturbing influences, it may be brought to bear afresh upon the facts.

Having as far as possible done this, let him contemplate an object—this book, for instance. Resolutely refraining from theorizing, let him now say what he finds. He finds that his consciousness is filled with the existence of the book. Does there enter into this state of his consciousness any notion about sensations? No: he finds that such notion, so far from being contained in his consciousness, has to be fetched from elsewhere, to the manifest disturbance of his then state of consciousness. Does he perceive that the thing he is conscious of is an image of the book? Not at all: so little does his consciousness know of any image, that it is only by remembering his metaphysical readings that he can suppose such image to exist. So long as he refuses to translate the facts into any hypothesis, he feels that he is conscious of the book, and not of an impression of the book—of an objective thing, and not of a subjective thing. He feels that the sole content of his consciousness is the book considered as an external reality. He feels that this recognition of the book as an external reality is a simple indivisible act. Whether originally separable into premisses and inference or not (a question which he manifestly cannot here entertain), he feels that this act is undecomposable. And, lastly, he feels that, do what he will, he cannot reverse this act—he cannot, whilst contemplating the book, believe that it is non-existent—he cannot conceive that where he sees it there is nothing. Hence, whilst he continues looking at the book, his belief in it as an external reality possesses the highest validity possible. It has the direct guarantee of the Universal Postulate; and it assumes the Universal Postulate *only once*.

Perhaps he will object that though this belief apparently involves but one assumption of the postulate, it really involves

two—that he not only postulates the object, but that in doing so he postulates himself. Doubtless if his thought is—"I know the book exists," he postulates himself as well as the object. But his primary thought is simply—"The book exists;" and his own being is no more postulated in that thought than it is in these words which express it. Sir William Hamilton does indeed assert that we are conscious of subject and object "in the same indivisible moment of intuition;" but as was hinted in passing, this assertion will not be uniformly assented to; and it here becomes needful to assign reasons for dissenting from it.

Under ordinary circumstances, the time during which any one state of consciousness continues uninterrupted is so brief that it is impossible to distinctly identify it. These words, though successively occupying the reader's mind as symbols, are yet so instantaneously followed by their meanings that their symbolism passes unobserved. Moreover, while recognizing and interpreting them, his mind is rapidly taking note of other things—of the paper they are printed on; of his hands; of other parts of his body within view; of the sensations that periodically lead him to change his posture; and of the sounds and movements going on around him. Manifestly, were there no other evidence, it might, on the one hand, be argued as before, that some of the phenomena thus rapidly succeeding one another must be very liable to be mistaken for simultaneous ones; whilst, on the other hand, it might be reasonably inferred that as the more observable facts of consciousness form a series, so do the less observable ones; and that strictly, no two things can be present to consciousness at the same instant, or known "in the same indivisible moment of intuition."

When we turn from ordinary circumstances to extraordinary ones, we obtain sufficiently clear indications of the fact that the consciousness of objective existence is accompanied by an unconsciousness of subjective existence. Let the thing perceived be a very astonishing one, and the observer becomes

perceptibly oblivious of himself. Our ordinary language recognizes this fact. We say of such an one that he is *absorbed* in contemplation; *lost* in wonder; has *forgotten* himself: and we describe him as afterwards *returning* to himself; *recollecting* himself. From a deeply interested spectator who is so far possessed by his perception as not to hear what is said to him, up to the stupified victim of an impending catastrophe, may be seen all grades of this state. Under this last and extreme degree of it, persons are killed, from the inability to recover their self-consciousness in time to avoid danger. Even those who, in such case, are not completely paralyzed, manifest much the same mental state; for it frequently happens that they are wounded without knowing it; and they are generally surprised to hear afterwards what they did whilst in peril—a fact proving that their actions were automatic rather than conscious. Probably most, on being reminded of these truths, will be able to recall the perceptible period, during which a startling sight or sound occupies consciousness to the exclusion of the idea of self; and all who do this will see that an ordinary perception as well as an extraordinary one, must, while it lasts, exclude the idea of self; but that it lasts too short a time to admit of the exclusion being observed.

A yet stronger reason for asserting that the subject is not postulated in perceiving an object, is, that the subject can itself become known only as an object. By his division of our perceptions into those of the object-object and those of the subject-object, Sir William Hamilton himself implies that all the things perceived by consciousness must be relatively objective; and that hence self-consciousness is possible only by regarding self objectively. This must be admitted, whichever view be espoused respecting the nature of the *ego*. If it be held that the cognition of self consists in the impressions of self received through the senses, and in combinations and recollections of them, the objective nature of the cognition is directly implied. If otherwise it be held that self is a some-

thing by which all impressions, both internal and external, are contemplated, then, as this something cannot contemplate itself directly, but can know itself only by contemplating its past acts—can know itself only by the objective registry which it has just left of itself—it must still be known objectively. Hence, on either hypothesis, to say that consciousness of subject and object is simultaneous, is to say that in perceiving one object we necessarily perceive another object—an assumption alike gratuitous and improbable. Nay, more; it is an assumption that will be found wholly inadmissible if we do but consider the bearing of the above argument on the acts of incipient intelligence. For if the notion of self be made up of those impressions of self received through the senses, then it is a manifest corollary that the infant's earliest perceptions must be unaccompanied by any notion of self; seeing that there at first exist no materials out of which that notion can be formed. And if, according to the alternative theory, the notion of self is that of a primitive undecomposable power by which all mental processes are achieved; it still follows that as this power can know itself only by contemplating the objective registry of its acts; and as some acts, some perceptions, must have been achieved before there can be any objective registry to contemplate; the notion of self cannot coexist with the first perceptions.

But, perhaps, the most conclusive disproof of Sir William Hamilton's doctrine is deducible from one of his own axiomatic principles. At page 49 of his "Discussions on Philosophy," &c., he says:—"Relatives are known only together: the science of opposites is one. Subject and object, mind and matter, are known only in correlation and contrast—and by the same common act." Now, were all antitheses those between self and not-self, nothing would remain to be said. But there are numberless antitheses, *both* members of which pertain to the not-self; and numberless others, *both* members of which pertain to self—of the one class, full and empty, moving and stationary, equal and unequal; of the other,

pleasure and pain, belief and disbelief, &c. According to the foregoing general law, each of these pairs of relatives can be known only by the contrast of its terms—motion only as the correlative of rest, and so on. But if the *ego* is always present to consciousness as the correlative of the *non-ego,* how can two elements of the *non-ego* ever be conceived as the correlatives of each other? If I can know *a part* only by contrast with *a whole,* then the two things present to consciousness together must be *whole* and *part.* If that which I contemplate as the correlative to *a part* is the *self* which recognizes it, then I cannot contemplate *whole* as its correlative. As, however, we know that *whole* and *part are* known as correlatives, it follows inevitably from the general principle above quoted, that in the act of recognizing the relation between them, it is impossible for me to recognize the relation between myself as subject, and either of them as object.

Thus there is good ground for the belief that the cognition of the *non-ego* does not involve a simultaneous cognition of the *ego*—ground which is strengthened by the remembrance that we can express cognition of objective being in words that involve no assertion of subjective being (the book exists), which we could not do did the one conception involve the other—and ground yet further strengthened by the consideration that we can perfectly well conceive an object to remain in existence after our own annihilation, *which it would be impossible to do if the cognition of subject and object were simultaneous, and consequently inseparable.* Further inquiry therefore serves to confirm, rather than to shake, the direct verdict of consciousness—that the cognition of an object as an external reality is an undecomposable mental act involving the Universal Postulate once only.

Turn we now to the hypotheses which serve as fulcra for the attempted overthrow of Realism, beginning, as we may properly do, with Hypothetical Realism—the comparatively unassuming one from which the others have sprung, but

whose parentage they have, in their high pretensions, found it convenient to ignore.

No one can form any conception of the representative hypothesis without abandoning his first centre of consciousness, in which he is simply percipient, and taking up another position, from which to inspect the act of percipience. A spectator gazing at a fire is simply conscious of the fire. If you tell him he cannot know the fire, but merely his impression of a fire, he can realize your meaning only by regarding both the fire and himself as objects, and observing how the one affects the other. What now is involved in this proceeding? He postulates the fire; he postulates himself; and he postulates the relation between these. In his original state of percipience, not only does his cognition of the fire seem immediate and undecomposable, but he cannot even conceive that it may be a compound cognition, without going much out of his way to do so. Whereas in this state to which you bring him, not only does the alleged representative cognition seem at once decomposable into three things, but he cannot even conceive it without the three things. In the one case he cannot by any effort use the postulate more than once: in the other, he cannot by any effort avoid using it three times.

Thus too is it with Absolute Idealism. Idealism assumes that minds are entities; that ideas are entities; and that ideas exist in minds. Even supposing that it has the guarantee of the Universal Postulate for each of these, yet, as involving them all, its proposition has three times the liability to error possessed by the proposition it sets out to disprove. Let it be granted that its belief—mind is an entity, is a belief proved by the inconceivableness of its negation to invariably exist (which is not the fact; for mind is conceivable as not an entity, but a *process*); let it be granted that it has the like authority for the belief—ideas are entities (which is not the fact; for ideas are conceivable as *phases of the process*, mind); and let it be granted, that for its belief—ideas exist in mind, it has this same highest warrant (which is not the fact; for it is con-

ceivable that ideas are not *in* mind but *are* mind)—let it be granted, I say, that each of these beliefs is indisputable: still, Idealism stands in the position of being unable to frame its hypothesis without thrice making an assumption which the adverse hypothesis makes but once.

At first sight, the scepticism of Hume, by not asserting the existence of mind, escapes this difficulty. But the escape is apparent only. In reality, Hume makes even more assumptions than Berkeley does. He sets out by saying, that our cognitions resolve themselves into *impressions* and *ideas*; and on this division all his reasoning hinges. Obviously, did he merely postulate these two things, the foundation of his argument would be less certain than the undecomposable belief he calls in question. But he artfully postulates more than two things, without seeming to do so. For what is contained in the concept—an impression? Translate the word into thought, and there are manifestly involved a thing impressing and a thing impressed. It is impossible to attach any idea to the word, save by the help of these other ideas. Without contending at length, as I might, that our conceptions of things impressing and things impressed are gained by seeing bodies act upon each other, and that we cannot realize these conceptions without supposing the objectivity of such bodies—without dwelling upon the illegitimacy of an argument which assumes that there are impressions, and then goes on to show that there are neither things impressing nor things impressed; and which thus, taking the *abstract* for its fulcrum, proposes to overset the *concrete* from which it is abstracted,—without dwelling upon this, it will suffice for present purposes to remark, that unless Hume postulates the three things—the impression, the impressing, and the impressed, his reasoning is meaningless from the very beginning. Unless its constituent words are the signs of thoughts, an argument is a mere game of symbols. Refrain from rendering your terms into ideas, and you may reach any conclusion whatever. The whole is equal to its part, is a proposition that may be quite comfortably

entertained so long as neither wholes nor parts are imagined. If, then, Hume's argument claim to be anything more than a string of logical forms containing no substance, its first term —an impression—must be used only as the representative of a definite concept; and no such definite concept can be formed without two other things—the impressing and the impressed —being involved. The existence of ideas being further involved as an essential part of Hume's premisses, it results that (saying nothing about the assumed *relation* between impressions and ideas) he postulates four things to the one thing postulated by Realism.

So that, even did these idealist, sceptical, and other kindred theories require no long chains of syllogisms to get from their premisses to conclusions at variance with Realism—were their conclusions immediately, instead of remotely, consequent on the premisses—they would still be placed in the dilemma that their respective assumptions are three and four times as liable to error as the assumption they dispute.

As a last resort it will perhaps be urged, that the proposition of Realism is still an inference, and not an intuition—that our notion of the externality of things is not immediate, but involves a synthesis. The first reply is, that we cannot possibly *know* that our notion of their externality is a synthesis, with anything like the certainty with which we can know that their externality is real. As the reasoning employed to prove the synthetic nature of the realistic belief, is itself a synthesis of a highly complicated kind, whilst the synthesis of Realism is one of the simplest possible—so simple as to have become organic—it follows that any such objection to Realism is, like the many kindred ones, self-destructive; it repeatedly assumes the validity of that whose validity it questions. The second reply is, that all knowledge whatever involves synthesis; and that no metaphysical hypothesis can be framed without a more complex synthesis than that required by Realism. Instance the proposition—Ideas exist in mind. Here are three syntheses. Idea is a general word applicable to various states of

consciousness; and, as we see in the child, comes to have a meaning only after the putting together of many experiences. Mind is a synthesis of states of consciousness—is a thing we can form no notion of without re-*membering*, re-*collecting* some of our mental acts. Every conception of relation is a synthesis—that of inclusion being one. The child is enabled to recognize one thing as *in* another, by a series of observations similar to, and simultaneous with, those that teach it the externality of things; and until these observations have been generalized, the proposition that ideas are *in* mind must be unthinkable. Thus, then, each of the words *idea, in, mind,* involves a synthesis; and the proposition—Ideas exist in mind, is a synthesis of syntheses. Passing from the assumptions of Idealism to its argument, it might be shown that each of its syllogisms is a synthesis of syntheses; and that its conclusion, reached by putting together many syllogisms, is a synthesis of syntheses of syntheses. Instead, then, of the realistic belief being objectionable on the ground of its synthetic nature, its superiority is, that it is less open to this objection than any other belief which can be framed.

The grossly fallacious character of every metaphysical doctrine at variance with ordinary credence, and of the scepticism which forms the logical outcome common to them all, will, however, from our present stand-point, be most vividly perceived on considering the general aspect and pretension of their arguments; or rather of the sceptical argument regarded as a type of the class. For, granting the sceptic his premisses, and making no objection to his reasoning, what is the sum total of his achievement? Simply this; that by a long and involved series of steps he brings Realism's belief in the existence of objects to a *reductio ad absurdum.* But his conclusion that objects do not exist, Realism brings to a *reductio ad absurdum* by a single step. At best, then, he does but offer a many-stepped *reductio ad absurdum* in place of a single-stepped one. What, now, is the worth of such an offer? If the *reductio ad absurdum* afford valid proof, the belief of Realism

is true. If it do not afford valid proof, what becomes of the sceptic's argument? Awkward as this dilemma looks, it will appear worse on remembering that every one of the many syllogisms by which scepticism reaches its goal, tacitly assumes the validity of the *reductio ad absurdum*. Not only where Hume from time to time says, "For 't is evident," and "'t is impossible to conceive," &c., but in every successive sentence, in everything he asserts, in everything he denies, he takes for granted the infallibility of the realist's test. He cannot move a single step on the way to his own conclusion, without postulating that which disproves his conclusion.

Scepticism, then, is reducible to this extreme predicament—that the assumption on which it founds its argument is less certain than the assumption it sets out to disprove; that each of the many steps in its argument is less certain (as involving a more complex synthesis) than the single step of the adverse argument; and that it cannot take any one of these many steps without endorsing that adverse argument.

§ 12. It is curious to see a doctrine which positively contradicts our primary cognitions, chosen as a refuge from another doctrine which simply doubts them. In the philosophy of Kant, however, this is done. Scepticism merely questions all things; and professes to decisively affirm nothing. Kantism, in anxiety to escape it, decisively affirms things contrary to universal belief. That Space and Time are "forms of sensibility" or "subjective conditions of thought" that have no objective basis, is as repugnant to common sense as any proposition that can be framed. And to adopt this proposition instead of the one that we have no sufficient evidence of any objective existence, seems to be a preference of the greater evil to the less.

Of the general criticisms that may be passed upon the hypothesis that Space and Time are conditions or forms of the *ego*, impressed by it on the *non-ego* in the act of perception, one is that it gratuitously entails difficulties to avoid what are not

difficulties. For if, in congruity with the ordinary belief, we suppose the *non-ego* to exist under certain universal conditions or forms, it will obviously follow that in being impressed upon the *ego* the *non-ego* must carry its universal conditions or forms along with it, and must generate in the *ego* corresponding conditions or forms that will be also universal. The facts, therefore, are quite explicable on the supposition that all knowledge is from experience. If, on the other hand, to explain these facts, it be assumed that the conditions belong to the *ego*, and the materials to the *non-ego*, it results that the *non-ego* is unconditioned. But unconditioned existence is inconceivable. Consequently, it becomes impossible to conceive that there can be any *non-ego* at all. If it be replied that the hypothesis itself involves that we cannot conceive anything without impressing our own forms of thought upon it, and that therefore an unconditioned *non-ego* is by the hypothesis inconceivable, even though existent, the rejoinder is, that an existence of which we have no evidence, which we cannot conceive, and which it is impossible that we should conceive, is an existence we have as strong a warrant for denying as we have for denying anything.

On turning from the abstract to the concrete, this gratuitous making of difficulties is still more clearly seen. The fact on which Kant bases his assertion, that Space is a subjective form and not an objective reality—the fact, namely, that we can conceive the annihilation of bodies, but cannot conceive the annihilation of Space—is a fact quite comprehensible on the hypothesis that all knowledge is from without. Making no attempt to analyse the notion of Space, which, even if here practicable, would entail too long a digression, it will suffice for present purposes to say that we know Space as *an ability to contain bodies*. I am aware that this is no definition properly so-called; seeing that as the words *contain* and *bodies* both imply ideas of Space, the definition involves the thing to be defined. But leaving out, as irrelevant, all consideration of the mode in which we come by our ideas of Space, and of

bodies as occupying Space, it will, I think, be admitted, that the antithesis between *bodies* and *an ability to contain bodies*, truly represents the contrast in our conceptions of the sensible *non-ego* (Matter) and the insensible *non-ego* (Space). And if we know Space as an ability to contain bodies, the fact that we cannot conceive its annihilation, is quite accountable on the experience-hypothesis. Bodies we can conceive annihilated, because, by evaporation, and by burning, we have seen them annihilated—annihilated, that is, to the senses. But the ability to contain bodies we cannot conceive annihilated, because we have never known it absent. In all our experience that ability has remained constant; and hence the conception of it is similarly constant in our minds. Evidently, then, our powerlessness to conceive the non-existence of Space requires no such hypothesis as that of Kant for its explanation.

Were it only that the experience-hypothesis explains all that the Kantian hypothesis is intended to explain, and does this without involving us in such insurmountable difficulties, its superiority would be sufficiently marked. But it does more. It accounts for a certain peculiarity in our conceptions of Space, which the Kantian hypothesis does not account for: this peculiarity being, that every conception of Space which can be formed by a single mental act is limited to such portion of Space as we can have experience of at one time. Let any one attempt to form an idea of the whole surrounding sphere of Space simultaneously, and he will find it impossible to do so. When standing upright, he can very well conceive the hemisphere of Space extending in front of him; but he cannot in the same act of thought include the hemisphere of Space that is behind. On watching his mind, he will perceive that in thinking of the Space that is behind, he becomes momentarily unconscious of the Space that is in front. If, to get rid of perturbing circumstances, he mentally abolishes the Earth and all objects, and supposes himself in an infinite void, he will still find that the infinity at any moment occupying his imagination

is the infinity extending on one side of him, and never the infinity on both sides. Now the Kantian hypothesis not only leaves this fact unaccounted for, but is at variance with it; for if Space be a form of thought, our conception of it should be simple, total, uniform, and altogether unrelated to external perception. Whereas, the experience-hypothesis not only accounts for it, but involves it, as an inevitable deduction; for if all knowledge is from without, the conception which we can by one act form of Space cannot exceed the perception which one act can give us of it. To the first theory the fact is an obstacle: to the second it is a confirmation.

Passing from these general criticisms to the fundamental criticism, the first thing to be noticed is, that Kant does involuntary homage to the Universal Postulate in assigning grounds for his dogma. Not to dwell upon the fact that his whole argument turns upon the existence of Space and Time, and that for the belief in their existence the Universal Postulate is his sole warrant; and only observing, by the way, that the distinction he draws between these and other things, hinges entirely upon conceivableness and inconceivableness; let us go on to remark, that he *infers* from our inability to conceive the annihilation of Space and Time, joined with our ability to conceive the annihilation of all other things—he *infers* from these facts, that Space and Time are receptivities, subjective conditions and not objective realities. We can conceive bodies non-existent: we cannot conceive Time and Space non-existent: *therefore,* Time and Space are forms of thought. What now is the worth of his "therefore?" At best merely this; that given these premisses, there arises an indestructible belief in this conclusion. Our conceptions of Time and Space comporting themselves thus; the inference that they are subjective, follows as a belief proved by the inconceivableness of its negation to invariably exist. Only reminding the reader that, as above shown, it does *not* thus follow; it is here to be observed that, granting his whole position, Kant has no higher guarantee

for his inference than the Universal Postulate. The thing *must* be so, he says: and the entire meaning of this *must* is, that no other thing can be conceived.

Having by implication assumed the validity of this canon of belief, whose warrant he wrongly supposes himself to have; what does Kant do? He forthwith asserts that which this canon denies; and denies that which this canon asserts. The subjectivity of Time and Space being, he alleges, irresistible as an *inference*, he insists on it as a *fact;* and to receive it as a fact involves two impossibilities—the forming of concepts of Time and Space as subjective forms, and the abolition of the concepts of Time and Space as objective realities. The truth is, that Kant's proposition is both positively unthinkable in itself, and immediately involves a positively unthinkable consequence.

Consider, first, the thing affirmed—that Time and Space are subjective conditions of thought, or properties of the *ego*. Is it possible to realize the meaning of these words? or are they not simply groups of signs which seem to contain a notion, but which really contain none? An attempt to construct the notion will quickly show that the last is the fact. Think of Space—of the thing, that is; not of the word. Now think of self—of that which is conscious. And then, having clearly realized these concepts, put the two together, and conceive the one as a property of the other. What results? Nothing but a conflict of two thoughts that cannot be united. It would be as practicable to imagine a round square. What, then, is the worth of the proposition? As Mr. Mansel, himself a Kantist, says in his subtle work, "Prolegomena Logica:"—

"A form of words uniting attributes not presentable in an intuition, is not the sign of a thought, but of the negation of all thinking. Conception must thus be carefully distinguished, as well from mere imagination, as from a mere understanding of the meaning of words. Combinations of attributes logically

impossible may be expressed in language perfectly intelligible. There is no difficulty in understanding the meaning of the phrase *bilinear figure,* or *iron-gold.* The language is intelligible, though the object is inconceivable."

If this be true, Kant's proposition is empty sound. If, as Sir William Hamilton says, those propositions only are conceivable of which subject and predicate are capable of *unity of representation,* then is the subjectivity of Space inconceivable; for it is impossible to bring the two notions, *Space* and *property of the ego,* into unity of representation.

Such being the character of the proposition affirmed, consider now the character of the proposition which is, by implication, denied; viz. that Time and Space are objective realities. The negation of this proposition is as inconceivable as the affirmation of the other. Neither Kant nor any one else ever rid himself of the belief in the externality of Space. That conception of it which he describes as incapable of annihilation is the conception of it as an external *non-ego;* and if this non-annihilability of the conception be appealed to as having any significance at all, it signifies the validity of the conception in its totality. In short, the belief in Space as an objective reality is a belief proved by the inconceivableness of its negation to invariably exist; and is, therefore, a belief having the highest possible certitude. And the same is manifestly true of Time.

See then the position in which Kant stands. He assumes, that from our inability to annihilate Space and Time in thought, the inference that they are subjective necessarily follows—follows as an inference whose negation is inconceivable. But the inference that they are subjective involves two inconceivable things. Kant's proceeding, then, is essentially an assertion of two inconceivabilities in place of one. Recognizing by implication the Universal Postulate, he, out of professed submission to its authority, straightway twice denies its authority. He chooses a double impossibility to escape from a single one. Granting his assumption, therefore, his pro-

position is indefensible; and when his assumption proves to be unwarrantable — when, as we have seen, the inference which he thinks necessary, turns out to be not necessary— the accumulated absurdity of his position becomes strikingly apparent.*

The systems of Fichte, Schelling, and Hegel, are manifestly open to parallel criticisms—criticisms, however, which, as being substantially repetitions of the foregoing, it is needless here to detail.

§ 13. Do we not thus, then, reach the desired reconciliation between Philosophy and Common Sense? We have seen— first, that the existence of beliefs is, in so far as our reasoning faculties are concerned, the fundamental fact; next, that be-

* It may be useful here to notice that Sir William Hamilton, who, from some passages in his writings (see, for instance, p. 882 of the "Dissertations"), might be supposed to hold that Space is *both* a law of thought and a law of things; but who proves himself to be a disciple of Kant by saying—"It is one merit of the philosophy of the conditioned, that it proves Space to be only a law of thought, and not a law of things;" has been led by his Kantism into a suicidal argument. In his trenchant criticism on Dr. Brown, he brings into strong relief the inconsistency of that writer by putting side by side two positions which he respectively receives and repudiates. The passage, which will be found at page 90 of the "Discussions," is as follows:—

"*I cannot but believe that material things exist:—I cannot but believe that the material reality is the object immediately known in perception.* The former of these beliefs, explicitly argues Dr. Brown, in defending his system against the sceptic, *because irresistible, is true.* The latter of these beliefs, implicitly argues Dr. Brown, in establishing his system itself, *though irresistible, is false.*"

Now when Sir William Hamilton asserts that Space is "only a law of thought, and not a law of things," he falls into an absurdity of exactly the same kind as the one which he here exposes. To show this it needs but to make a small addition to the foregoing passage, and to change the names, thus:—

I cannot but believe that material things exist:—I cannot but believe that the material reality is the object immediately known in perception:—I cannot but believe that the space in which material realities are perceived is objectively real. The two former of these beliefs, explicitly argues Sir William Hamilton, in defending his system against the sceptic, *because irresistible, are true.* The latter of these beliefs, implicitly argues Sir William Hamilton, in establishing his system itself, *though irresistible, is false.*

And thus Sir William Hamilton, by asserting the untrustworthiness of consciousness, himself overthrows his own system.

liefs which invariably exist are those which, both logically and of necessity, we must adopt; further, that those are invariably existent beliefs, of which we cannot conceive the negations; and, lastly, that whether beliefs having this warrant be infallible or not, it must equally happen that the fewer times we assume the validity of such warrant in reaching any conclusion, the more certain must that conclusion be. These positions being granted; it inevitably results, as we have found, that the current belief in objects as external independent entities, has a higher guarantee than any other belief whatever—that our cognition of existence considered as noumenal, has a certainty which no cognition of existence considered as phenomenal, can ever approach; or, in other words—that, judged logically as well as instinctively, Realism is the only rational creed; and that all adverse creeds are self-destructive.

From our present point of view, not only does the seeming discordance between the verdicts of abstract and practical reason wholly disappear, but their verdicts explain each other. On the one hand, the extreme vividness and unconquerable strength of our common-sense convictions answer to the extreme brevity of the process by which each of them is arrived at; or, in other words—to the single assumption of the Universal Postulate which each of them involves. On the other hand, the shadowy and unconvincing character of metaphysical inferences answers to the extreme complexity of the arguments by which they are drawn; that is—to the numerous assumptions of the Universal Postulate they severally imply. Thus our involuntary adhesion to the first, and our inability to hold the last, answer to their respective claims as measured by the fundamental test of credibility. The instinct justifies the logic: the logic accounts for the instinct. It was hinted at the outset, that an inquiry into our knowledge by means of our knowledge, must, if rightly conducted, be consistent in its results—that the analysis of Philosophy must agree with the synthesis of Common Sense. This we now find to be the fact: not simply as shown in

the coincidence of their conclusions; but as further shown in the rationale afforded by the one of the confidence felt by the other.

Here, too, we may remark the identity of the illusion common to all metaphysical reasonings; the illusion, namely, that our cognition of logical necessity has a higher certainty than our cognition of anything else. Not recognizing the fact, that for the validity of every step in an argument, we have no better guarantee than we have for an intuition of sense; but assuming, on the contrary, that whilst our simple perceptions of external existences are fallible, our complex perceptions of internal existences are infallible—assuming this, men have sought to reach by reasoning, a knowledge that transcends ordinary knowledge. Like Kant, they have thought it "a *scandal to philosophy,* and human reason in general, to be compelled to accept the existence of external things on the testimony of mere *belief.*" That it is possible by a chain of syllogisms to gain a conviction more positive than any conviction immediately derived from the senses, is the assumption which every metaphysical argument tacitly makes. The endeavour by one school to establish an Ontology, and the assertion by another, that we cannot prove the existence of noumena, alike take for granted that demonstration has a validity exceeding that of intuition. To Common Sense, standing steadfastly on a given spot, the first says that there is a series of steps by which that spot may be arrived at; the second says that there is no such series; but they agree in saying, that until a series of steps has been gone through, Common Sense cannot stand on that spot at all. This superstition in mental dynamics has a curious analogy to a current superstition in physical dynamics. Much as the mechanic, familiar with the effects of levers, wheels, and pulleys, has come to attribute to them intrinsic powers; the metaphysician, struck with the results achieved through logical forms, ascribes a virtue to the forms themselves: and as the one hopes by an arrangement of these levers, wheels, and pulleys, to generate force; so does the other hope by some

logical combination to evolve certainty. In both cases, however, the result is directly the reverse. As every additional part of a mechanical apparatus entails a loss of force, so does every syllogism entail a loss of certainty. As no machine can produce an effect equivalent to the moving power, so no argument can establish a conclusion equally certain with that primary knowledge on which all argument is based.

§ 14. Before closing, it will be desirable, both with a view of preventing any possible misconstruction, and for the purpose of meeting the last objections of scepticism, to specify the extent to which the foregoing reasonings justify the convictions of Common Sense. At first sight, it is liable to be inferred that as our cognitions of external realities, immediately reached through the senses, have a higher validity than any cognitions mediately reached by reasoning, so also have our cognitions of all their apparent properties. But this is not true. Though the Universal Postulate endorses our beliefs in an outer world and in personal existence—in Matter, Force, Space, Time, Change, Motion, Extension, Form, and the so-called primary attributes of things—it does not endorse our beliefs in colour, scent, sound, and the attributes classed as secondary. For while our beliefs in the first are of the kind whose negations are inconceivable, we can, after a little analysis, very readily conceive the negations of our beliefs in the last.

"But," it may be asked, "how happens it that while in assigning to a body the property of occupying space, the direct verdict of consciousness is trustworthy, it is not trustworthy in assigning to such body the property of redness? Is not the last cognition, like the first, reached by a single act of thought involving the Universal Postulate once only? Nay, indeed, is not the cognition of redness a simpler one than the cognition of extension of three dimensions? And must we not, therefore, say that, judged by the canon of belief,

the cognition of redness is, if anything, the more certain of the two?"

The difficulty here started would seem to reopen the whole question. Were there no other mode of meeting it, however, there would still be the sufficient answer that the truth of a belief proved by the inconceivableness of its negation to invariably exist, being the one thing beyond all question, it follows that if some of our beliefs *are* thus proved invariably existent, whilst some *are not*, we have no alternative but to class them as certain and uncertain respectively. But, besides this general reply, there are special ones.

In the first place, it is to be remarked that that disbelief in the objectivity of heat, of scent, of sound, considered as such, which a cultured intelligence attains to, is not at all of the same order as Idealism's disbelief in matter and space. It is a disbelief quite reconcilable with the facts of consciousness. Just as a higher knowledge has enabled us to interpret the daily rising and setting of the sun as implying, not his motion round the earth, but the rotation of the earth on its axis; so, a higher knowledge enables us to interpret the phenomena of heat, scent, and sound, as not inherent in things, but as effects produced by things upon us. In either case we come to conceive the facts under new relations; and in either case our ability so to conceive them, implies that the new conception does not conflict with our fundamental beliefs. The modification in our mode of regarding them still allows to colour, sound, and the rest, a substantive existence in the external world, though not under the forms in which we cognize them—does not, like Scepticism, present them under the inconceivable form of impressions which there is nothing to produce.

Possibly, however, it will be argued, as it may be argued, that to admit the invalidity of immediate consciousness in respect to the so-called secondary properties of things, is to throw doubt upon its validity in all other cases; that as the advance

of intelligence has enabled us to recognize these secondary properties as merely phenomenal, so, a still further advance may enable us to recognize the primary properties also, as merely phenomenal; and that thus Matter, Force, Space, Time, and the external world in general, may ultimately be reduced to the same category with the rest, as purely subjective existences.

The most satisfactory reply to this is one that unfortunately cannot now be given; based as it is upon truths that are to be reached only by a Special Analysis. Could it here be shown, as it will be shown in a subsequent part of this work, that our cognitions of the so-called secondary properties of things, differ in nature fundamentally from our cognitions of the so-called primary properties, the impossibility of such a result as that just suggested would be at once seen. Even without the aid of any Special Analysis, however, it may, I think, be rendered certain that no such result can ever occur.

For the possibility of disproving these primordial beliefs would imply that there exist data of superior certitude on which a disproof may be built. The reasoning by which it is demonstrated that colour and sound, as conceived by us, are simply subjective impressions, takes for granted the objectivity of Space, Force, and Matter—cannot reach its conclusion without postulating the external world and its primary attributes. And as, without these fulcra, Natural Philosophy would be unable to overthrow the vulgar beliefs in sound and colour as objective realities, so, without some yet more solid fulcra can Scepticism never shake the universal beliefs in an external world and its primary attributes. But no such fulcra exist. Not only has it been shown that, as measured by the number of times the Universal Postulate is assumed in arriving at them respectively, the cognitions with which Idealism and Scepticism set out, are far less certain than the cognitions they call in question; but it has been shown that our cognitions of external existence have the highest guarantee that any

cognitions are capable of (§ 11). As, consequently, there can never be found cognitions having a higher certainty, there can never be found data on which a disproof of our realistic convictions can be based.

To this there seems one only rejoinder possessing any plausibility; namely, that though some of our realistic convictions must ever remain invulnerable, yet others of them may hereafter undergo a transformation like that which our aboriginal convictions respecting colour and sound have done—that as certain of our beliefs concerning objective attributes have been abolished by a logical combination of certain other of our beliefs concerning them, so may yet further beliefs concerning objective attributes be abolished. Could the conclusions reached by the Special Analysis be here cited, it might be shown in detail that such a result is not possible—that the primary attributes are involved in the very conception of an external world. But it must suffice for the present to say again, as was said when commenting upon the controversy respecting necessary truths, that as the inability to conceive the negation of a belief implies the agreement of all past experience in its support; and as no belief whatever of which human nature is capable can have any higher warrant than this; we are justified in holding as valid, all such of Realism's propositions as have the Universal Postulate for their guarantee:—knowing that the *essential elements* of its creed can never be shaken, from want of a fulcrum; and not admitting the hypothetical possibility that *some* elements of its creed may yet be shaken to have any weight.

It remains but to notice Scepticism's last refuge; namely, the position that even granting Realism's propositions to be incapable of disproof—even granting the externality of things to be indisputable—even granting the indisputableness of those fundamental attributes involved in the conception of this externality—yet we can never truly know that these exist as we understand them to exist. Whilst it may ever remain impossible for us to think of them as otherwise, yet they may

be otherwise. This position we shall find to be as logically inadmissible as it is practically unthinkable. For one of two things must be true of it. It must either admit of no justification by reason, or it must admit of some justification. If it admits of no justification by reason, then it amounts to a tacit negation of all reason. It posits that as possible, which, by its own admission, can be entertained not as a conceivable proposition, but only as a verbally intelligible one; and if it be allowable, without assigning grounds, to do this in the present case, it is allowable to do it in any case: whence it will follow that every conclusion can be met by a counter conclusion which may be posited as possible; and all conclusions being thus rendered worthless, intelligence is abolished. If, on the other hand, reasons in justification of the position be assigned — if it be alleged that we cannot know that things exist as we understand them to exist, *because* we cannot transcend consciousness; then there is at once taken for granted the validity of that test whose validity is called in question. The Universal Postulate is assumed and denied in the same breath. As already more than once shown, the invariably existent belief, which is our warrant for asserting the reality of Matter, Motion, Space, and Time, is likewise our warrant, and our sole warrant, for every *because*: and to assume the trustworthiness of this warrant in the one case for the purpose of proving its untrustworthiness in the other, is the climax of absurdity. Evidently, then, we cannot rationally entertain a thought at variance with these primary dicta of consciousness. We cannot take a single step towards invalidating Realism without committing a logical suicide.

CHAPTER IV.

OUR PRESENT POSITION.

§ 15. Before proceeding it will be desirable to consider the position in which the foregoing General Analysis leaves us.

It was shown at the outset that a datum was needed on which psychological science might rest: it was pointed out that this datum, underlying as it was required to do all our beliefs, must consist in some criterion of a true belief: and this criterion was found to be the invariable existence of the belief, as proved by the inconceivableness of its negation. The conclusion thus reached, however, being entirely abstract, and Psychology requiring for its basis not simply a canon of true belief, but some substantive things believed; we saw it requisite to ascertain which of our cognitions had the highest possible validity. These we found to be the cognitions of an external world; of the primary properties of things; of personal existence: in short, those which make up the Realistic creed—cognitions that far exceed in trustworthiness all those on which antagonistic arguments are based; and immeasurably exceed in trustworthiness the results of those arguments. These primary cognitions, then, we may consider as good against all criticism. True though it is that the datum from which we start is an assumption, a postulate—true though it may be that its absolute validity must ever remain beyond proof; yet, as this is the necessary character of a datum—as in any case that which serves to prove all other things must itself remain unproved—and as no intellectual procedure, not even scepticism itself, is possible on any other condition; we are left utterly without power to stir this fundamental basis. As was lately shown, to question this primordial cognition on which every other cognition mediately or immediately stands, is tantamount to a nega-

tion of all knowledge whatever; and even this negation destroys itself at the very moment of its utterance.

The fact, however, now most requiring to be noticed—a fact which, though implied in the last sentence, demands specific statement—is, that this canon of belief, together with the primary intuitions which have its direct warrant, form the foundation not simply of Psychology, but of Science in general—not simply of subjective knowledge, but of knowledge considered as objective. Regarded under its most comprehensive aspect, the science of mind is the counterpart of all other sciences, which are but registered results of mental action: and whether, confining ourselves to the external world, we treat of the truths to be recognized in it; or whether, confining ourselves to the internal world, we treat of the intellectual acts by which such truths are recognized; we are equally compelled to take for our data, the Universal Postulate and its corollaries. As already shown, the axioms of Mathematics and Logic, in common with the infinitude of conclusions built upon them, have no other warrant: and there is no other warrant for either the intuitions of self-conciousness or those logical processes by which Psychology is to be evolved from these intuitions. Here is the common root to the science of mind and the science of nature—the point from which they diverge.

Whence it would seem to follow that the foregoing General Analysis forms a requisite preliminary, not only to any system of subjective knowledge, but to any system of objective knowledge; and in strictness this is true. If a warrant be asked for the assertion that if equals be taken from equals the remainders are equal, Mathematics has none to give. And as, for this and the various other ground truths with which the positive sciences set out, there *does* exist a warrant—an authority common to them all—it may be contended that this common authority should be assigned at the outset. Still, however, as this authority can be found only by a subjective inquiry, objective science cannot give it; but must wait until it is supplied by Psychology. As, under a last analysis, what we here distinguish

as objective and subjective truths must both be classed as in reality subjective; it is clear that their common root must be subjective. Hence in any general scheme of human knowledge, the inquiry concerning ultimate data may properly form, as it here does, the first division of Psychology.

It needs only to be further remarked that the conclusions arrived at in the preceding pages, must not be expected to make any conspicuous appearance in the investigations now to be entered upon. Resulting, as this General Analysis does, in a verification of our primitive cognitions, it simply furnishes us with a valid warrant for those cognitions as hereafter employed. Usually such cognitions, whether of concrete fact or of logical necessity, are assumed as true without any warrant being assigned. Here, however, the assignment of a warrant for them falls within our special subject. But the warrant once having been assigned, these cognitions will be dealt with as usual. *Implicitly* the Universal Postulate and its corollaries will be appealed to in every step of the following reasonings, as of all reasonings; but *explicitly* the reference to them will be but occasional.

PART II.

SPECIAL ANALYSIS.

CHAPTER I.

COMPOUND QUANTITATIVE REASONING.

§ 16. An analysis conducted in a truly systematic manner, must commence with the most complex phenomena of the series to be analysed: must seek to resolve these into the phenomena that stand next in order of complexity: must proceed after like fashion with the less complex phenomena thus disclosed: and so, by successive decompositions, must descend step by step to the simpler and more general phenomena; reaching at last the simplest and most general. As applied to Psychology this mode of procedure, though perhaps, if patiently pursued, the best in its results, is beset with difficulties. The most ordinary operations of consciousness are sufficiently perplexing to those whose thinking powers have not been well disciplined; and its highly involved operations, if dealt with at the outset, may naturally be expected to tax the powers even of the habitual student. Disadvantageous, however, in this respect, as such an arrangement of the subject may be, both to reader and writer, it is so much better fitted than any other for the adequate presentation of the general law which it is the object of this Special Analysis to disclose, that I do not hesitate to adopt it. A little patience only is asked during the perusal of the next few chapters; which will be comparatively abstract and uninteresting. What he finds in them that is not very comprehensible, the reader must pass over until subsequent chapters give the key to it. Should some of the matters discussed seem to him unimportant, perhaps he will suspend his judgment until their bearing upon the doctrine at large becomes visible. And if, as is very possible, he should not perceive the reason for interpreting certain mental phenomena after a particular fashion—for insisting upon a special mode

of regarding them and defining them—he is requested to take the analyses upon trust; in the belief that he will presently see them to be the true ones, and eventually see them to be the only possible ones. Thus much premised, let us pass to our immediate topic—Compound Quantitative Reasoning.

§ 17. Of ratiocinative acts exhibiting a high degree of complexity, the following will fitly serve as an example. Suppose an engineer who has constructed a bridge—say an iron tubular bridge—of given span, and who finds that it is just strong enough to bear the strain it is subject to (a strain resulting mainly from its own weight)—suppose such an engineer is required to construct another bridge of like nature, but of double the span. Possibly it will be supposed that for this new bridge he might simply magnify the previous design in all its particulars—simply make the tube double the depth, double the width, and double the thickness, as well as double the length. But, duly acquainted as he is with mechanical principles, he sees that a bridge so proportioned would not support tself—he infers that the depth, or the thickness of the metal, or both, must be more than double. Now by what acts of thought does he reach this conclusion? He knows, in the first place, that the bulks of similar masses of matter are to each other as the cubes of the linear dimensions; and that consequently, when the masses are not only similar in form, but of the same material, the weights also, are as the cubes of the linear dimensions. He knows, too, that in similar masses of matter which are subject to compression or tension, or, as in this case, to the transverse strain, the power of resistance varies as the squares of the linear dimensions. Hence he sees that if another bridge be built proportioned in all respects, exactly like the first, but of double the size, the weight of it—that is, the gravitative force, or force tending to make it bend and break—will have increased as the *cubes* of the dimensions; while the cohesive force—that is, the sustaining force, or force by which the breaking is resisted—will have increased only as

the *squares* of the dimensions: and that, therefore, the bridge will give way. Or, to present the reasoning in a more formal manner, he sees that the—

$$\left.\begin{array}{l}\text{Sustaining force}\\ \text{in the small tube}\end{array}\right\} : \left\{\begin{array}{l}\text{Sustaining force}\\ \text{in the large tube}\end{array}\right\} :: 1^2 : 2^2$$

whilst at the same time he sees that the—

$$\left.\begin{array}{l}\text{Destroying force}\\ \text{in the small tube}\end{array}\right\} : \left\{\begin{array}{l}\text{Destroying force}\\ \text{in the large tube}\end{array}\right\} :: 1^3 : 2^3$$

Whence he infers that as the destroying force has increased in a much greater ratio than the sustaining force, the larger tube cannot sustain itself; seeing that the smaller one has no excess of strength.

But now, leaving out of sight the various acts by which the premisses are reached and by which the final inference is drawn, let us consider the nature of the particular mental process implied by the cognition that the ratio between the sustaining forces in the two tubes, must differ from the ratio between the destroying forces: for this process it is which here concerns us as an example of the most complex ratiocination. There is, be it observed, no direct comparison between these two ratios. How then is it known that they are unlike? It is known by the intermediation of two other ratios, to which they are severally equal.

The ratio between the two sustaining forces *equals* the ratio $1^2 : 2^2$. The ratio between the two destroying forces *equals* the ratio $1^3 : 2^3$. And as it is seen that the ratio $1^2 : 2^2$ is unequal to the ratio $1^3 : 2^3$; it is by implication seen, that the ratio between the sustaining forces is unequal to the ratio between the destroying forces. What now is the nature of this implication? or rather—What is the mental act by which this implication is perceived? It is manifestly not decomposable into steps. Though involving many elements, it is a single intuition: and if expressed in an abstract form, amounts to the axiom—Ratios which are severally equal to certain other ratios that are unequal to each other, are themselves

unequal: or, reducing it to a still more abstract form—Relations which are severally equal to certain other relations that are unequal to each other, are themselves unequal.

I do not propose here to enter upon an analysis of this highly complex intuition; but simply present it as an example of the more intricate acts of thought which occur in Compound Quantitative Reasoning—an example to which the reader may presently recur if he pleases. A nearly allied but somewhat simpler intuition will better serve to initiate our analysis.

§ 18. This intuition is embodied in an axiom which has not, so far as I am aware, been specifically stated; though it is taken for granted in Proposition XI. of the fifth book of Euclid; in which, as we shall presently see, the wider of two assumptions is assigned in proof of the narrower. This proposition, which is to the effect that "Ratios which are equal to the same ratio are equal to one another," it will be needful to quote in full.* It is as follows:—

"Let A be to B as C is to D; and as C is to D so let E be to F. Then A shall be to B as E to F.

G————	H————	K———
A———	C———	E——
B——	D———	F—
L———	M————	N———

Take of A, C, E, any equimultiples whatever G, H, K; and of B, D, F, any equimultiples whatever L, M, N.† Therefore

* In some editions the enunciation runs,—"Ratios which are the same to the same ratio are the same to each other;" but the above is much the better.

† For the aid of those who have not lately looked into Euclid, it will be well to append the definition of proportionals, which is as follows:—"If there be four magnitudes, and if any equimultiples whatsoever be taken of the first and third, an any equimultiples whatsoever of the second and fourth, and if, according as the multiple of the *first* is greater than the multiple of the *second*, equal to it, or less, the multiple of the *third* is also greater than the multiple of the *fourth*, equal to it or less; then, the *first* of the magnitudes is said to have to the *second* the *same ratio* that the *third* has to the *fourth*."

since A is to B as C to D, and G, H, are taken equimultiples of A, C, and L, M, of B, D; if G be greater than L, H is greater than M; and if equal, equal; and if less, less. Again, because C is to D as E to F, and H, K, are equimultiples of C, E; and M, N, of D, F; if H be greater than M, K is greater than N; and if equal, equal; and if less, less. But if G be greater than L, it has been shown that H is greater than M; and if equal, equal; and if less, less: therefore, if G be greater than L, K is greater than N; and if equal, equal; and if less, less. And G, K are any equimultiple whatever of A, E; and L, N, any whatever of B, F; therefore as A is to B so is E to F."

Let us now, for the sake of simplicity, neglect all such parts of this demonstration as consist in taking equimultiples and drawing the immediate inferences; and inquire by what process is established that final relation amongst these equimultiples which serves as the premiss for the desired conclusion. And to make the matter the clearer, let us here separate these equimultiples from the original magnitudes; and consider by itself the argument concerning them.

G———————— H———————— K————
L———— M———————— N————

From the hypothesis and the construction, it is proved that if G be greater than L, H is greater than M; and if equal, equal; and if less, less: and, similarly, that if H be greater than M, K is greater than N; and if equal, equal; and if less, less. Whence it is inferred (and here comes the *petitio principii*) that if G be greater than L, K is greater than N; and if equal, equal; and if less, less. That this is an assumption, under a less definite form, of the very thing to be proved, will readily be seen on simplifying the verbiage. For what, in general language, is the fact established when it is shown that if G be greater than L, H is greater than M; and if equal, equal; and if less, less? The fact established is, that whatever relation subsists between G and L, the same relation

subsists between H and M: whether it be a relation of superiority, of equality, or of inferiority: in other words, that *so far as they are defined,* the relations G to L and H to M are equal. So, too, with the relations H to M and K to N, which are proved to be equal in respect to the characteristics predicated of them. And then, when it has been shown that the relation G to L equals the relation H to M; and that the relation K to N also equals it; it is said that *therefore* the relation G to L equals the relation K to N. Which *therefore,* involves the assumption that relations which are equal to the same relation, are equal to each other—an assumption differing only in its higher generality from the proposition that "Ratios which are equal to the same ratio, are equal to each other,"—an assumption which itself needs proof, if the proposition to be established by it needs proof.

The only rejoinder which it seems possible to make to this criticism is, that in asserting that if G be greater than L, H is greater than M; and if equal, equal; and if less, less; it is *not* asserted that the relation G to L *equals* the relation H to M: for that, without negativing the assertion, G may be supposed to exceed L in a greater proportion than H exceeds M; and that, in this case, the relations will not be equal. One reply is, that the possibility of this supposition arises from the extreme vagueness of the definition of proportional magnitudes; and that it needs only to seize the true meaning of that definition, to see that no such assumption is permissible. Not to dwell upon this, however, it is a sufficient answer to the objection, that though the relations G to L, and H to M, are left to some extent indeterminate, and cannot therefore be called equal in an absolute sense, yet, *so far as they are determinate,* they are equal; and that if it be allowable to assume of indeterminate relations, that in the respects in which they are equal to the same, they are equal to each other, it must be allowable to assume as much of determinate relations. This will be clearly perceived on considering the matter under any one of its concrete aspects. Suppose

it to have been shown that if G be greater than L, H is greater than M; and that if H be greater than M, K is greater than N; then it is said that if G be greater than L, K is greater than N. What now are here the premisses and inference? It is argued that the first relation being like the second in a certain particular (the superiority of its first magnitude); and the third relation being also like the second in this particular; the first relation must be like the third in this particular. If now it be allowable to assume that two relations which are severally like a third in any particular, are like each other in that particular; it is allowable to assume as much when they are like in all particulars, or are equal. The one truth is not more self-evident than the other. The act of thought is the same in each case; and is valid either in both or in neither. Evidently, then, the reasoning involves a disguised *petitio principii.*

Thus the general truth that relations which are equal to the same relation are equal to each other—a truth of which the foregoing proposition concerning ratios is simply one of the more concrete forms—must be regarded as an axiom. Like its prototype—things that are equal to the same thing are equal to each other—it is incapable of proof. Seeing how closely, indeed, the two are connected both in nature and origin, perhaps some will contend that the one is but a particular form of the other, and should be included under it—that a *relation* is simply one species of *thing;* and that what is true of all things is, by implication, true of relations. Much as may be said in support of this position, it is, however, necessary, as will presently be seen, to specifically enunciate this general law in respect to relations, even if it be held derivative. At the same time the criticism serves to bring into yet clearer view the axiomatic nature of the law. For whether it be or be not true that a relation must be regarded as a thing, it is unquestionably true that in any intellectual process serving to establish the general fact—Relations that are equal to the same

relation are equal to each other—the concepts dealt with are the relations, and not the objects between which the relations subsist; that the equality of these relations can be perceived only by making *them* the objects of thought, and not by thinking of the related objects; and that hence the axiom, being established by the comparison of three concepts, is established by just the same species of mental act as though it referred to substantive things instead of relations.

The truth—Relations that are equal to the same relation are equal to each other—which we thus find is known by an intuition,* and can only so be known, underlies many important geometrical truths. An examination of the first proposition in the sixth book of Euclid, and of the deductions made from it in succeeding propositions, will show that there is a large class of theorems having this axiom for their basis—theorems which are at present ostensibly based upon the demonstration above shown to be fallacious.

§ 19. But this axiom has far wider and far more important applications. It is the foundation of all Mathematical Analysis.

* Here, and throughout, I use this word in its ordinary acceptation as meaning any cognition reached by an undecomposable mental act; whether the terms of that cognition be *presented* or *represented* to consciousness. Sir William Hamilton, in classing knowledge as *representative* and *presentative* or *intuitive*, restricts the meaning of intuition to that which is known by external perception. If, when a dog and a horse are looked at it is seen that one is less than the other, the cognition is intuitive; but if a dog and a horse are imagined, and the inferior size of the dog perceived in thought, the cognition is not intuitive in Sir William Hamilton's sense of the word. As, however, the act by which the relation of inferiority is established in consciousness, is alike in the two cases, the same term may properly be applied to it. And I draw further reason for using the word in its common acceptation, from the fact that the line of demarcation between presentative and representative knowledge cannot be maintained. Though there is much knowledge that is purely representative, there is none that is purely presentative. Every perception whatever involves more or less of representation. And this is asserted by Sir William Hamilton himself, when, in opposition to Royer Collard's doctrine, that perception excludes memory, he writes, "On the contrary, I hold, that as memory, or a certain continuous representation, is a condition of consciousness, it is a condition of perception."

Alike in working out the simplest algebraic equation, and in performing those higher analytical processes of which algebra is the root, it is the one thing perpetually taken for granted. Whilst other axioms are specifically stated, this axiom is tacitly assumed at every step. It is true that the assumption is limited to that particular case of the axiom in which its necessity is so self-evident as to be almost unconsciously recognized; but it is not the less true that this assumption cannot be made without involving the axiom in its entire extent. The successive transformations of an equation we shall find to be linked together by acts of thought, of which this axiom expresses the most general form. Let us take an example and analyse it.

$$\begin{aligned} x^2 + 2x &= 8 \\ x^2 + 2x + 1 &= 9 \\ x + 1 &= \pm 3 \\ x &= 2 \text{ or } -4. \end{aligned}$$

Now it may seem that the only assumptions involved in these three steps are—first, that if equals be added to equals, the sums are equal; second, that the square roots of equals are equals; and third, that if equals be taken from equals, the remainders are equal. But a little reflection will show that the several results reached in virtue of these assumptions lead to no conclusion if they stand alone: and they cannot be co-ordinated to any purpose without some further assumption being made. What is that assumption? As at present written, there is nothing to mark any connexion between the first form of the equation and the last. Manifestly, however, the validity of the inference $x = 2$, depends upon there being some perfectly specific connection between it and the original premiss $x^2 + 2x = 8$; and this connection implies connections between the intermediate steps. This premised, the real process of thought involved will be at once recognized on inserting the required symbols, thus:—

$$\begin{array}{rcl} x^2 + 2x & = & 8 \\ & \| & \\ x^2 + 2x + 1 & = & 9 \\ & \| & \\ x + 1 & = & 3 \\ & \| & \\ x & = & 2. \end{array}$$

That only in virtue of the successive cognitions thus represented does the conclusion legitimately follow from the original premiss, cannot fail to be seen, on considering that the argument is worthless unless the value of x in the last form of the equation, is the same as its value in the first; and that this implies the preservation throughout of a constant relation between the function of x and the function of its value under all their transformations—a constancy which is more strictly expressed by saying that their successive relations are equal. But now arises the question—In virtue of what assumption is it that the final relation subsisting between the two sides of the equation is asserted to be equal to the initial one? On this assumption it is that the worth of the conclusion ultimately depends; and for this assumption no warrant is assigned. I answer, the warrant for this assumption is the axiom—Relations that are equal to the same relation are equal to each other. Probably, at first sight, it will not be altogether manifest that this axiom is involved. It needs but to simplify the consideration of the matter, however, to render the fact apparent. Suppose that we represent the successive forms of the equation by the letters A, B, C, D. If now A, B, C, D had represented substantive things; and if, when it had been shown that A was equal to B, and B was equal to C, and C was equal to D, it had been concluded that A was equal to D; what would have been assumed? There would have been two assumptions of the axiom—Things that are equal to the same thing are equal to each other: one to establish the equality of

A and C by the intermediation of B; and one to establish the equality of A and D by the intermediation of C. Now, the fact that A, B, C, D do not represent things, but represent relations between things, cannot be supposed fundamentally to alter the intellectual process by which the equality of the first and last is recognized. If, when A, B, C, D represent things, the equality of the first and last can be shown only by means of the axiom—Things that are equal to the same thing are equal to each other; then, manifestly, when A, B, C, D represent relations, the equality of the first and last can be shown only by means of the axiom—Relations that are equal to the same relation are equal to each other.

It is true that in this case the relations dealt with are relations of equality; and the great simplification hence resulting may produce some hesitation as to whether the process of thought really is the one described. Perhaps it will be argued that the successive forms of the equation being all, in virtue of their essential nature, relations of equality, it is known by an act of direct intuition that any one of them is equal to any other; or that if an axiom be appealed to, it is the axiom—All relations of equality are equal to each other. It must, without doubt, be conceded, that relations of equality, unlike all other relations and unlike all magnitudes, are in their very expression so defined as that the equality of any one of them to any other may be foreknown. But admitting this, the objection may be met in two ways. In the first place, it may be replied that every relation of equality can be known to equal every other relation of equality only through the cognition—Relations that are equal to the same relation are equal to each other. For like all general truths it must be originally derived from particular experiences: the particular experience forming the first step to it must be a perception of the equality of some two relations of equality: further progress towards the general truth requires a perception of the equality of one of these to some third relation of equality: and now be it observed that any further carrying out of this pro-

cess to a fourth and a fifth, cannot lead to the generalization that *all* relations of equality are equal, until they have been compared in some other than their serial order. As in the case of magnitudes that have been recognized as successively equal, each to the next, the assertion that they are *all* equal implies an act of thought in which some two that are not adjacent have been perceived to be equal in virtue of their common equality to an intermediate third; so, in the case of relations, however obviously they are all equal, a like act of thought must be gone through. Yet a simpler proof is assignable. As the truth—All relations of equality are equal to each other, is more general than the truth—Relations of equality, that are equal to the same relation of equality are equal to each other; it must include this last; and cannot be reached without presupposing it. If this reply be considered inconclusive—as it will possibly be by those who contend for innate forms of thought—the second reply may be given; namely, that the relation subsisting between the two sides of an equation when reduced to its final form, is known to be a relation of equality only in virtue of its affiliation upon the original relation of equality, by means of all the intermediate relations. Strike out in the foregoing case, the several transformations which link the first and last forms of the equation together, and it cannot be logically known that x *is* equal to 2. If then this ultimate relation can be known to equal the first, only because it is known to equal the penultimate relation, and the penultimate relation to equal the antepenultimate, and so on; it is manifest that the affiliation of the last relation upon the first, unavoidably involves the axiom—Relations that are equal to the same relation are equal to each other.

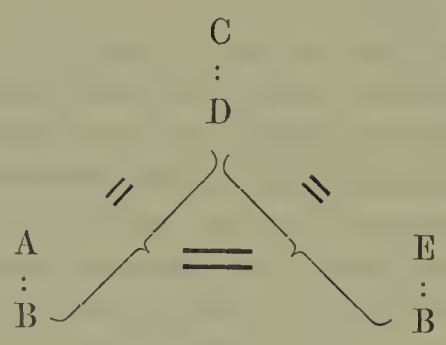
It must be admitted that in cases like these in which this general axiom is applied to relations of equality, it seems very much like a superfluity—a formula that is more circuitous than the intuition it represents. And it is doubtless true that in such cases the cognition seems to merge into a simpler order of cognitions, from which it is with difficulty distin-

guishable. Nevertheless, I think the arguments adduced warrant the belief that the mental process described is gone through; though perhaps almost automatically: and indeed, if, when the relations are not relations of equality, the intuition expressed by this axiom is consciously achieved, it seems unavoidably to follow, that when the relations are those of equality, it is also achieved, even if unconsciously. And for this belief yet further warrant will be found, when, under another head, we come to consider the case of inequations—a case in which no such source of difficulty exists, and yet in which the process of thought is of like nature.

§ 20. Leaving here its several applications, and turning to consider the axiom itself, as being predicable alike of all relations, whether of equality or any degree of inequality, we have now to inquire by what process of thought it is known that relations which are equal to the same relation are equal to each other. We have seen that the fact is not demonstrable, but can be reached only by direct intuition. What is the character of this intuition?

Clearly if the equality of the first and third relations cannot be established by an act decomposable into steps, but can be established only by a single act, that single act must be one in which the first and third relations are brought into immediate relation before the consciousness. Yet any direct comparison of the first and third without the intermediation of the second would avail nothing; and any intermediation of the second would seem to involve a thinking of the three in their serial order—first, second, third; third, second, first—which, even could it be called a single act, would not bring the first and third into the immediate relation required. Hence, as neither a direct comparison of the first and third, nor a serial comparison of the three, can fulfil the requirement, it follows as the only remaining alternative, that they must be compared in couples. And this is what is really done. By the premisses it is known that the first and second relations are

equal; and that the second and third relations are equal. There are, therefore, presented to consciousness, two relations of equality between relations. The direct intuition is that these two relations of equality are themselves equal. And as these two relations of equality possess a common term, the intuition that they are equal, *involves* the equality of the remaining terms. The nature of this mental process will, however, be best expressed by symbols. Suppose the several relations to stand thus:—A : B = C : D = E : F, then the act of thought by which the equality of the first and third relations is recognized may be symbolized thus:—*



Careful introspection will, I think, confirm the inference that this represents the mental process gone through—that the first and second relations, contemplated as equal, form together one concept; that the third and second, similarly contemplated, form together another concept; and that, in the intuition of the equality of these concepts, the equality of the terminal relations is implied: or that to define its nature abstractedly—the axiom expresses an intuition of the equality of two relations between relations.

Probably to the minds of some readers, this analysis will

* The sign (:) used in mathematics to express a ratio, is, in this formula, as in many that follow, placed somewhat unusually in respect to the letters it connects, with a view to convenience of reading. And it may here be explained in preparation for subsequent chapters, that this sign, though here marking, as it commonly does, a ratio, or *quantitative relation*, will hereafter be employed to mark *any relation*.

not at once commend itself. Indeed, as at first remarked, it is an inconvenience attendant on commencing with the most complex intellectual processes, that the propriety of formulating them after a certain manner cannot be clearly perceived until the analysis of the simpler intellectual processes has shown why they must be thus formulated. After reading the next few chapters, the truth of the above conclusion will become manifest. In the meantime, though it may not be positively recognized as true by its perceivable correspondence with the facts of consciousness, it may yet be negatively recognized as true by contemplating the impossibility, lately shown, of establishing the equality of the first and last relations by any other intellectual act.

Before ending the chapter it should be observed, that the relations thus far dealt with are relations of magnitudes; and, properly speaking, relations of homogeneous magnitudes; or, in other words, *ratios*. In the case of the geometrical reasoning quoted from the fifth book of Euclid, this fact is definitely expressed; and though in the case of the algebraical reasoning it may at first be thought that the magnitudes dealt with are not homogeneous—seeing that the same equation often includes at once magnitudes of space, time, force, value,—yet it needs but to consider that these magnitudes can be treated algebraically only by reducing them to the common denomination of *number*—only by considering them as abstract magnitudes of the same order, to at once see that the relations dealt with are really those subsisting between homogeneous magnitudes—are really *ratios;* and might have been so named throughout. The motive for constantly speaking of them under the general name, *relations,* of which ratios are but one species, will be understood when it is seen, as it presently will be, that only when regarded under this most general form do they permit the intellectual processes by which they are co-ordinated to be brought under the same category with other acts of reasoning.

CHAPTER II.

COMPOUND QUANTITATIVE REASONING (*CONTINUED*).

§ 21. THE results reached in the last chapter do not, apparently, help us very far on the way to a theory of Quantitative Reasoning. Such an intuition as that expressed in the axiom educed, can form but one amongst the many intuitions which, joined together, constitute a mathematical argument. A moment's reflection will show that however many times quoted, or applied in thought, the axiom—Relations which are equal to the same relation are equal to each other, can never do anything else than establish the equality of some two relations by the intermediation of a series of relations severally equal to both: and there are few if any cases, save those furnished by algebraic and allied processes, in which the equality of two relations is the fact to be arrived at; or could be thus arrived at if it were. The proposition—"If two circles touch each other externally, the straight line which joins their centres shall pass through the point of contact," is one with which such an axiom can have no concern: and the same is manifestly the case with the great majority of geometrical truths. Some more general cognition, then, has to be found.

Guidance in the search for such a cognition, may be drawn from the consideration that if a truly fundamental one, it must be involved not only in all other kinds of quantitative reasoning, but *also* in the kind exemplified in the preceding chapter. It must underlie both. This being an *à priori* necessity, it follows that as, in the case of algebraic reasoning, the foregoing axiom expresses in general language the sole cognition by which the successive steps are rationally co-ordinated, the required fundamental cognition must be somehow involved in it. I

seems therefore, that our best course will be to continue the line of analysis already commenced.

If then, ceasing to consider in its totality the complex axiom —Relations which are equal to the same relation are equal to each other, we go on to inquire what are the simpler elements of thought into which it is proximately decomposable; we at once see that it twice over involves a recognition of the equality of some two relations. Before it is possible to predicate that the relations A : B and E : F being severally equal to the relation C : D, are equal to each other; it must first be predicated that the relation A : B *is* equal to the relation C : D; and that the relation C : D *is* equal to the relation E : F. Hence the intellectual act which we have now to consider, is the establishment of a relation of equality between two relations. And this is the intellectual act of which we are in search. An intuition of the equality of two relations is implied in every step, alike of that quantitative reasoning which deals with homogeneous magnitudes, and that which deals with magnitudes that are not homogeneous—is the ultimate ratiocinative act into which every complete mathematical argument is resolvable. Let us take as our first field for the exemplification of this fact, the demonstration of geometrical theorems.

§ 22. Before analysing the steps by which a proposition is proved, we may with advantage contemplate the substance of a proposition; and consider by what process the mind advances from that particular case of it which the demonstration establishes, to the recognition of its general truth. Let us take as an example, the proposition—"The angles at the base of an isosceles triangle are equal to each other."

To establish this, the abstract terms are forthwith abandoned, and the proposition is re-stated in a concrete form. Let A B C be an isosceles triangle of which the side A B is equal to the side A C; then the angle A B C shall be equal to the angle A C B. By a series of steps which need not be here specified, the way is found from these premisses to this conclu-

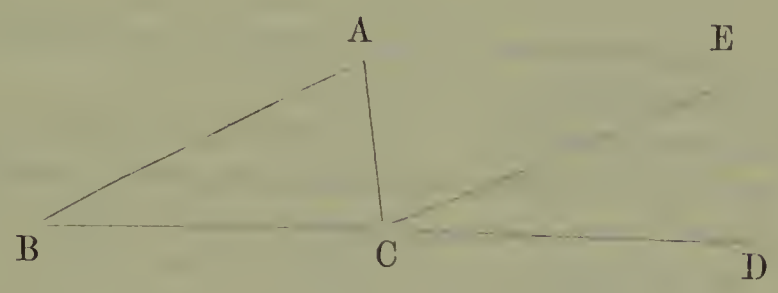
sion. It is definitely demonstrated that the angle A B C *is* equal to the angle A C B. But now mark what takes place. As soon as this particular fact has been proved, the general fact is immediately re-enunciated and held to be proved. We pass directly from the concrete inference—the angle A B C is equal to the angle A C B, to the abstract inference—*therefore* the angles at the base of an isosceles triangle are equal to each other. Q. E. D. Be the cogency of every step in the demonstration what it may, the truth of the proposition at large hinges entirely upon the cognition that what holds in this case holds in all cases. What now is the nature of this cognition? It is a consciousness of the equality of two relations: on the one hand, the relation subsisting between the sides and angles of the triangle A B C; and on the other hand, the relation subsisting between the sides and angles of another isosceles triangle, of any isosceles triangle, of all isosceles triangles. Whatever theory be espoused respecting the mode in which we figure to ourselves a class—whether in the present case the abstract fact be recognized only after it has been seen to hold in this isosceles triangle, and in this, and in this; or whether after it has been seen to hold in some ideal type of an isosceles triangle; does not in the least affect the position that the thing discerned is the equality of the relations presented in successive concepts. If we use the letter A to symbolize the premised fact (viz. that in the triangle A B C the sides A B and A C are equal), and the letter B to symbolize the fact asserted (viz. that the angle A B C is equal to the angle A C B); then, after establishing a certain relation (of coexistence) between A and B in this one case, we go on to affirm that the same relation holds between some other A and B, or all As and Bs: or strictly speaking, not the *same* relation, but an *equal* relation. And as, for this affirmation, we can assign no reason, it manifestly represents a simple intuition.

But not only do we pass from the special truth to the general truth by an intuition of the equality of two relations: a like intuition is implied in each of the steps by which the special truth is reached. In the demonstration of such special truth,

the truths previously established are explicitly or implicitly referred to; and the relations that subsist in the case in hand are recognized as equal to relations which those previously established truths express. This will be at once seen on subjecting a demonstration to analysis. The one belonging to the foregoing theorem is inconveniently long: we shall find a fitter one in Proposition xxxii.

"If the side of any triangle be produced, the exterior angle is equal to the two interior and opposite angles; and the three interior angles of every triangle are together equal to two right angles."

"Let A B C be a triangle, and let one of its sides B C be produced to D; then the exterior angle A C D is equal to the two interior and opposite angles C A B, A B C; and the three interior angles of the triangle, namely A B C, B C A, C A B, are together equal to two right angles."



DEMONSTRATION.

"From the point C draw the straight line C E parallel to A B; and because A B is parallel to C E, and A C meets them, the alternate angles B A C, A C E are equal."

ANALYSIS.

It was demonstrated in a previous case that there is a relation of coexistence between the parallelism of two lines and the equality of the alternate angles made by a line meeting them: it is perceived that the parallelism of the lines must coexist with the equality of the angles in this case also: that is, the present relation is seen to be equal to a relation previously established.

"Again, because A B is parallel to C E, and B D falls upon them, the exterior angle E C D is equal to the interior and opposite angle A B C;"

In a foregoing proposition it was shown that of the angles made by a line cutting two parallel lines, the exterior is equal to the interior and opposite: here there are two parallel lines and a line cutting them: and the cognition which the demonstration expresses is, that the relation between lines and angles which held before, holds now—that this is a like relation, an equal relation.

"but the angle A C E was shown to be equal to the angle B A C; therefore the whole exterior angle A C D, is equal to the two interior and opposite angles C A B, A B C."

Immediate intuitions: first, that the whole is equal to its parts; and second, that things which are equal to the same thing are equal to each other. Which last, as we shall see at a future stage, is an intuition of the equality of two relations.

"To these angles add the angle A C B; then the angles A C D, A C B are together equal to the three angles C B A, B A C, A C B."

An intuition that when to equal magnitudes the same magnitude is added, the sums are equal: an intuition which is itself a consciousness of the equality of two relations—the relation that subsists between the magnitudes before the addition is made, and the relation that subsists after it is made.

"But the angles ACD, ACB, are together equal to two right angles;"

In a previous case it was ascertained that the angles which a straight line made with another straight line upon one side of it, were either two right angles, or equal to two right angles; and the thing now perceived is, that the relation between lines and angles in this case, is exactly like the

"therefore also the angles C B A, B A C, A C B are together equal to two right angles."

"Therefore if a side of any triangle be produced, the exterior angle is equal to the two interior and opposite angles; and the three interior angles of every triangle are equal to two right angles. Q. E. D."

relation in that case—that the two relations are equal.

An intuition that things which are equal to the same thing are equal to each other: which, as before hinted, is itself known through an intuition of the equality of two relations.

An intuition that the relation between lines and angles found to subsist in this triangle, subsists in any triangle, or in all triangles—that the relation in every other case, is equal to the relation in this case.

Thus, alike in each step by which the special conclusion is reached, and in the step taken from that special conclusion to the general one, the essential operation gone through is the establishment in consciousness of the equality of two relations. This is the bare abstract statement of the thing effected. If this is not done, nothing is done. And as, in each such cognition, the mental act is undecomposable—as for the assertion that any two such relations are equal, no reason can be assigned save that they are perceived to be so; it is manifest that the whole process of thought is thus expressed.

§ 23. Perhaps it will be deemed scarcely needful specifically to prove that each step in an algebraic argument is of the same nature. But though, by showing that the axiom—Relations which are equal to the same relation are equal to each other, twice involves an intuition of the above described kind, it may have been implied that the reasoning which proceeds upon that axiom, is built up of such intuitions; yet it will be well definitely to point out that only in virtue of such intuitions do the successive trans-

formations of an equation become allowable. Unless it is perceived that a certain modification made in the form of the equation, leaves the relation between its two sides the same as before—unless it is seen that each new relation established is *equal* to the foregoing one, the reasoning is vicious and the result erroneous. A convenient mode of showing that the mental act continually repeated in one of these analytical processes is of the kind described, is suggested by an ordinary algebraic artifice. When a desired simplification may be thereby achieved, it is usual to throw any two forms of an equation into a proportion: a procedure in which the equality of the relations is specifically asserted. Here is an illustration: not such an one as the algebraist would choose; but one which will serve present purposes.

$$2xy = y^2$$
$$2x = y$$
$$2xy : y^2 :: 2x : y$$

or, as it is otherwise written,

$$2xy : y^2 = 2x : y$$

and if proof be needed that this mode of presenting the facts is legitimate, we may at once obtain it by multiplying extremes and means; whence results the truism—

$$2xy^2 = 2xy^2.$$

This clearly shows that the mental act determining each algebraic transformation, is one in which the relation expressed by the new form of the equation is recognized as equal to the relation which the previous form expresses. Only in virtue of this equality is the step valid: and hence the intuition of this equality must be the essence of the step.

CHAPTER III.

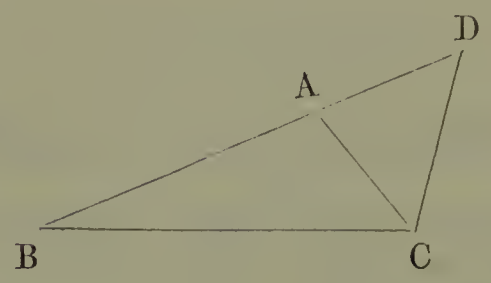
IMPERFECT AND SIMPLE QUANTITATIVE REASONING.

§ 24. Ability to perceive equality implies a correlative ability to perceive inequality: neither can exist without the other. But though inseparable in origin, the cognitions of equality and inequality, whether between things or relations, altogether differ in this; that whilst the one is essentially definite, the other is essentially indefinite. There is but one equality; but there may be numberless degrees of inequality. To assert an inequality, involves the affirmation of no fact, but merely the denial of a fact; and hence, as positing nothing specific, the cognition of inequality can never be a premiss to any specific conclusion.

Thus it happens that reasoning which is *perfectly* quantitative in its results, proceeds *wholly* by the establishment of equality between relations, the members of which are either equal, or one a known multiple of the other: and that, conversely, if any of the magnitudes standing in immediate relation are neither directly equal, nor the one equal to so many times the other; or if any of the successive relations which the reasoning establishes are unequal; the results are *imperfectly* quantitative. This truth is illustrated in that class of geometrical theorems in which it is asserted of some thing that it is greater or less than some other; that it falls within or without some other; and the like. Let us take as an example the proposition—"Any two sides of a triangle are together greater than the third side."

"Let A B C be a triangle; any two sides of it are, together, greater than the third side; namely, B A, A C, greater than B C; and A B, B C, greater than A C; and B C, C A, greater than A B."

"Produce B A to D, and make A D equal to A C; and join D C."



"Because D A is equal to A C, the angle A D C is equal to the angle A C D;"	A relation equal to a previously established one.
"but the angle B C D is greater than the angle A C D;"	An immediate intuition of inequality.
"therefore the angle B C D is greater than the angle A D C."	An immediate intuition of the equality of two relations of inequality, which have one term in common, and the other terms equal.
"And because the angle B C D is greater than the angle B D C, and that the greater side is opposite to the greater angle, the side D B is greater than the side B C;"	A relation equal to a previously established one.
"but D B is equal to B A, A C;"	An immediate intuition that when to two magnitudes standing in the relation of equality, the same magnitude is added, the resulting relation equals the original relation.
"therefore B A, A C are greater than B C."	An immediate intuition of the equality of two relations of inequality

which have one term in common, and the other terms equal.

"In the same manner it may be demonstrated that the sides A B, B C are greater than C A, and B C, C A greater than A B."

The relations subsisting in other cases are equal to the relation subsisting in this case.

It will be observed, that throughout this demonstration, though the magnitudes dealt with are unequal, yet the relations successively established are always equal to certain other relations: though the primary relations (between things) are those of inequality, yet the secondary relations (between relations) are those of equality. And this holds in the majority of imperfectly quantitative arguments. Though, as we shall by and by see, there are cases in which both the magnitudes and the relations are unequal, yet they are comparatively rare; and are incapable of any but the simplest forms.

§ 25. Another species of imperfectly quantitative reasoning occupies a position in mathematical analysis, like that which the foregoing species does in mathematical synthesis. The ordinary algebraic inequation supplies us with a sample of it. Thus, if it is known that $a + \frac{x^2}{\sqrt{y}}$ is less than $a + x\sqrt{y}$, the argument instituted is as follows:—

$$\begin{aligned} a + \frac{x^2}{\sqrt{y}} &< a + x\sqrt{y} \\ \frac{x^2}{\sqrt{y}} &< x\sqrt{y} \\ x^2 &< xy \\ x &< y. \end{aligned}$$

Now, in this case, as in the case of equations, the reasoning proceeds by steps, of which each asserts the equality of

the new relation to the relation previously established: with this difference, that instead of the successive relations being relations of equality, they are relations of inferiority. That the general process of thought, however, is alike in both, will be obvious on considering that as the inferiority of x to y can be known only by deduction from the inferiority of $a + \frac{x^2}{\sqrt{y}}$ to $a + x\sqrt{y}$, and as it can be so known only by the intermediation of other relations of inferiority; the possibility of the argument depends upon the successive relations being recognized as severally equal. It is true that these successive relations need not be specifically equal; but they must be equal in so far as they are defined. In the above case, for example, the original form of the inequation expresses a relation in which the first quantity bears a greater ratio to the second, than it does in the subsequent transformations; seeing that when equals are taken from unequals, the remainders are more unequal than before. But though in the *degree* of inferiority which they severally express, the successive relations need not be equal; yet they must be equal in so far as being all relations of inferiority goes: and this indefinite inferiority is all that is predicated either in premiss or conclusion.

Here, too, should be specifically remarked the fact hinted in a previous chapter; namely, that the reasoning by which one of these inequations is worked out, palpably proceeds upon the intuition that relations which are equal to the same relation are equal to each other. The relations being those of inequality, the filiation of the last upon the first can only thus be explained: and the parallelism that subsists between inequations and equations, in respect of the mental acts effecting their solutions, confirms the conclusion before reached that in equations that intuition is involved, though less manifestly.

It remains to be pointed out that, of imperfect quantitative reasoning, the lowest type is that in which the inequality of

the successive relations is expressed in its most general form —a form which does not define the relations as either those of uperiority or inferiority. For instance:—

$$\frac{x^2}{y} \text{ is unequal to } y$$

$$x^2 \text{ is unequal to } y^2$$

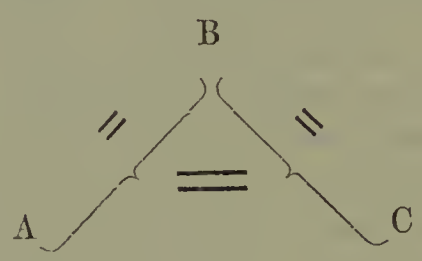
$$x \text{ is unequal to } y.$$

In this case the deductive process is the same as before: the uccessive relations are perceived to be alike in respect to their inequality; though it is not known whether the antecedents or the consequents are the greater. There is a definite co-ordination of the successive relations; though each relation is itself defined to the smallest possible extent. And, starting from this as the least developed type, we may see that the type previously exemplified, in which the antecedents are known to be greater or less than the consequents, is an advance towards those highest forms in which the antecedents and consequents are either directly equal, or the one equal to some specified multiple of the other.

§ 26. Incidentally, simple quantitative reasoning has been to a considerable extent treated of in the course of the foregoing analyses. The successive steps into which every compound quantitative argument is resolvable are all simple quantitative arguments; and we have already found that they severally involve the establishment of equality or inequality between two relations. It will be convenient, however, to consider by themselves, a class of simple quantitative arguments which are of habitual occurrence in the compound ones: some of them axioms; some nearly allied to axioms.

Let us commence with the familiar one—"Things which are equal to the same thing, are equal to each other." It may be shown by reasoning like that already used in a parallel case, that this truth is reached by an intuition of the equality of

two relations. Thus, putting A, B and C, as the three magnitudes, it is clear that for the equality of A and C to be discerned, they must be presented to consciousness in two states, of which the one immediately succeeds the other. But if A and C are contemplated alone, in immediate succession, their equality cannot be recognized; seeing that it is only in virtue of their mutual equality to B, that they can be known as equal. And if, on the other hand, B is interpolated in consciousness, and the three are contemplated serially—A, B, C, or C, B, A,—then A and C do not occur in the required juxtaposition. There remains no alternative, therefore, but that of contemplating them in pairs, thus :—



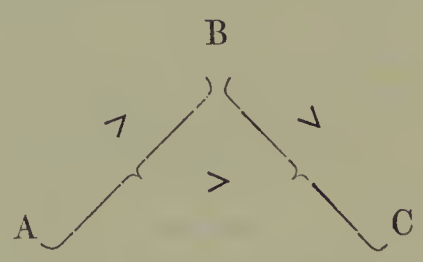
When A and B are united together in the single concept—a relation of equality; and when B and C are united into another such concept; it becomes impossible to recognize the equality of these two relations of equality which possess a common term, without the equality of the other terms being involved in the intuition.

But, perhaps, the most conclusive mode of showing that the mental act is of the kind described, will be to take a case in which some of the magnitudes dealt with have ceased to exist. Suppose A to represent a standard unit of measure preserved by the State; and let a surveyor be in possession of a measure B, which is an exact copy of the original one A; suppose, further, that in the course of his survey the measure B is broken; and that in the meantime the building containing the standard measure A, has been destroyed by fire: nevertheless, by purchasing another measure C, which had also been made to match the standard A, the surveyor is enabled

to complete his work; and is perfectly satisfied that his later measurements will agree with his earlier ones. What is the process of thought by which he perceives this? It cannot be by comparing B and C: for one of these was broken before he got the other. Nor can it be by comparing them serially—B, A, C, and C, A, B: for two of them have ceased to exist. Evidently, then, he thinks of B and C, as both copies of A: he contemplates the *relations* in which they respectively stood to A: and in recognizing the sameness or equality of these relations, he unavoidably recognizes the equality of B and C. And here it will be instructive to notice a fact having an important bearing, not only on this, but on endless other cases: the fact, namely, that the mind may retain a perfectly accurate remembrance of a *relation*, when it is unable to retain an accurate remembrance of the *things* between which it subsisted. Supposing that in the above case the surveyor has had opportunities, at the respective times when he bought them, of comparing B and C with A. It becomes possible for him, at any time afterwards, to remember with perfect precision the relation of equality in which B stood to A: he can see in thought that exact agreement which they displayed when placed side by side, with as much completeness as though he were again observing it. But it is impossible for him to remember the magnitudes themselves, with anything like this precision. He finds that by figuring in imagination two objects which he has seen at different times, but has never compared, he can form an approximate idea of their relative magnitudes, if they are markedly different; but, if they are nearly of a size, he is as likely to be wrong as right in saying which is the greater. If, then, two magnitudes separately observed, cannot afterwards be so distinctly represented in consciousness as that their equality or inequality can be determined; and if, on the other hand, a relation of equality that was once remarked between two magnitudes *can* be represented in consciousness with perfect distinctness, and recognized as equal to some

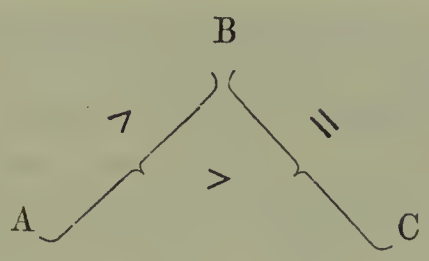
other relation of equality; then it becomes manifest that, in cases like the above, the truth perceived *cannot* be reached by remembering the magnitudes, but *can* be reached by remembering the relations. And thus we have demonstrative proof that the process of thought is as was stated.

Diverging from this original type are certain intuitions in which the thing cognized is the equality, not of two relations of equality having a common term, but of two relations of inequality having a common term. Thus, if A is greater than B, and B greater than C, then A is greater than C: and the like holds if they are severally less instead of greater. The act of thought may be symbolized thus:—



The relation A to B being given as a relation of superiority, while that of C to B is given as a relation of inferiority, it is known that the relation A to B is greater than the relation C to B; and as the term B, is common to the two relations, the intuition that the relation A to B is greater than the relation C to B, cannot be formed without involving the intuition that A is greater than C.

Diverging again from this type and its converse are others, having in common with it the characteristic that the two compared relations are perceived to be not equal, but unequal. For example, if A is greater than B, and B is equal to C; we know that A is greater than C. Similarly, if A is less than B, we know it is less than C. And if the first relation is one of equality and the second is one of inequality, there is a parallel intuition. In these cases, or rather in the first of them, we may express the mental act thus:—



Here, as before, the magnitude B being common to both, the relation A to B cannot become known as greater than the relation C to B without the superiority of A to C being known. Two relations having a common term cannot be conceived unequal, unless the remaining terms are unequal. And just as two magnitudes placed side by side, cannot be perceived unequal without its being at the same time perceived which is the greater; so, of two conjoined relations, one cannot be perceived greater than the other, without its being at the same time perceived which includes the greater magnitude. Should any one hesitate as to the correctness of these analyses, he has but to revert to the method of inquiry before followed, and consider by what process the conclusion is reached when some of the magnitudes have ceased to exist, to at once see that no other acts of thought can suffice.

The species of intuition serving to establish the equality of the successive forms of an equation—a species of intuition by which are recognized the general truths that the sums of equals are equal; that the differences of equals are equal; that if equals be multiplied by equals the products are equal, and if divided by equals the quotients are equal—is also accompanied by a converse species of intuition, in which the fact recognized is the inequality of two relations. Perhaps the simplest cases are the antitheses of the foregoing ones. They are seen in such axioms as—If to equals, unequals be added, the sums are unequal; and—If equals be divided by unequals, the quotients are unequal. But some of the intuitions of this order exhibit a higher degree of complexity: instance those by which it is known that if from unequals, equals be taken, the remainders are more unequal; and conversely, that if to unequals, equals be

added, the sums are less unequal. To which general cases may be added the specific ones in which the first pair of unequals being known to stand in a relation of superiority, the second pair are known to stand in a still greater relation of superiority, or a less relation, according to the operation performed; and similarly, when the relation is one of inferiority. Thus if $A + c$ is greater than $B + c$, then in a still higher degree is A greater than B—an intuition which may be expressed in symbols as follows:—

$$\left.\begin{matrix} A + c \\ \vdots \\ B + c \end{matrix}\right\} < \left\{\begin{matrix} A \\ \vdots \\ B \end{matrix}\right.$$

For present purposes it is needless to detail the varieties of intuition belonging to this class. It will suffice to remark, alike of these cases in which the thing perceived is the inequality of two relations, and of the antithetical cases in which the equality of two relations is perceived, that they differ from the previous class in this; that the relations are not conjoined ones, but disjoined ones. There are never three magnitudes only: there are always four. Throughout the first series, of which the simplest type is the axiom—"Things which are equal to the same thing are equal to each other," there is invariably one term common to the two relations; whilst throughout the second series, of which as a typical sample we may take the axiom—"If equals be added to equals, the sums are equal," the compared relations have no term in common. Hence it happens that in this second series, the relations being perfectly independent and distinct, the mental processes into which they enter are more readily analyzable. It is at once manifest that the groups of axioms above given, severally involve an intuition of the equality or inequality of two relations; and indeed the fact is more or less specifically stated throughout: seeing that in each case there is a certain relation, the terms of which are

modified after a specified manner, and there is then an assertion that the new relation is or is not equal to the old one—an assertion which, being based on no argument, expresses an intuition.

One further fact respecting these two groups of intuitions remains to be noticed; namely, that they have a common root with those which proportions express. The one group is related in origin to that species of proportion in which the second of three magnitudes is a mean between the first and third; and the other group to that species in which the proportion subsists between four separate magnitudes. Thus the axiom—"Things which are equal to the same thing are equal to each other," may, if we call the things A, B and C, be written thus:—

$$A : B :: B : C.$$

And again, the axiom—"The sums of equals are equal," may, if we put A and B for the first pair of equals, and C, D for the second pair, be expressed thus:—

$$A : B :: A + C : B + D.$$

This fundamental community of nature being recognized, it will at once be perceived that the intuitions by which proportions are established, differ from the majority of the foregoing ones, simply in their greater definiteness—in their completer quantitativeness. The two compared relations are always exactly equal, whatever the magnitudes may be—are not joined by the indefinite signs meaning greater than or less than: and when the proportion is expressed numerically, it not only implies the intuition that the two relations are equal; but the figures indicate what multiple, or submultiple, each magnitude is of the others.

CHAPTER IV.

QUANTITATIVE REASONING IN GENERAL.

§ 27. Leaving details, and considering the facts under thei most general aspect, it is to be remarked that Quantitative Reasoning involves, with more or less constancy, the three ideas, eoextension, eoexistence and connature:* or to speak less aecurately, but more eomprehensibly—sameness in the quantity of space oceupied; sameness in the time of presentation to eonsciousness; and sameness in kind. The germ out of which Quantitative Reasoning grows—the simple intuition of the equality of two magnitudes, necessarily involves all these: seeing that there ean be no eomparison between them unless they are of the same kind; and their coextension cannot be perceived unless they are eoexistent. So too with geometry, throughout its entire range. Eaeh of its propositions predicates the eoextension or non-eoextension of two or more connatural things whieh coexist: and its demonstrations proceed by asserting that eertain coexistent, eonnatural things are invariably eoextensive, or the reverse; or that eertain conna tural and eoextensive things invariably eoexist with eertain other things. When the propositions are numerical, and when, as frequently happens in Algebra and the calculus generally *duration* is one of the elements dealt with, it would appea that coexistenee is not involved; and further, that when *force* and *value* are the other elements of the question, there is not even any implication of coextension. These, however, are illusions resulting from the abstraet charaeter of numerical

* I coin this word partly to avoid an awkward periphrasis; and partly to indicate the kinship of the idea signified, to the ideas of coexistence and coextension. As we have already in use the words *connate* and *connatural*, the innovation is but small; and will, I think, be sufficiently justified by the requirement.

symbols. Simply representing as these do, equal units, and groups of equal units, of any order whatever; and being, as it were, created at any moment for the purposes of calculation; numerical symbols seem at first sight, independent alike of Space and Time; and able to establish quantitative relations between magnitudes that are not homogeneous. The fact, however, is exactly the reverse. On tracing them back to their origins, we find that the units of Time, Force, Value, Velocity, &c., which figures may indiscriminately represent, were at first measured by equal units of Space. The equality of times, becomes known either by means of the equal spaces traversed by an index, or the descent of equal quantities (space-fulls) of sand or water. Equal units of weight, were obtained through the aid of a lever having equal arms (scales); and were obtainable in no other way. The problems of Statics and Dynamics are primarily soluble, only by putting lines to represent forces. Mercantile values are expressed in units, which were at first, and indeed are still, definite weights of metal; and are therefore, in common with units of weight, referable to units of linear extension. Temperature is measured by the equal lengths marked alongside a mercurial column. And similarly, all the definitely quantitative observations of science, are made by means of subdivisions of linear space. Thus, abstract as they have now become, the units of calculation, applied to whatever species of magnitudes, do really represent equal units of linear extension; and the idea of coextension underlies every process of mathematical analysis. Similarly with coexistence. Numerical symbols are, it is true, purely representative; and hence may be regarded as having nothing but a fictitious existence. But one of two things must be admitted respecting the reasoning processes carried on by means of them. Either these processes imply a conscious reference to the things symbolized—in which case the equalities predicated in them are really those which were previously observed between coexistent things; or else the things symbolized cease to be thought of, and the relations among the

symbols are alone considered—in which case these symbols require to be made coexistent to consciousness before their relations can be determined. In fact, the phenomena of motion and sequence can be treated quantitatively, only by putting coexistent magnitudes to represent magnitudes that do not coexist. The relative lengths of two times, not being ascertainable directly, has to be indirectly ascertained, by comparing the spaces which a clock-finger traverses during the two times; that is, by comparing coexistent magnitudes. In brief, regarding it in the abstract, we may say that the Calculus in general is a means of dealing with magnitudes that do not coexist, or are not homogeneous, or both, by first translating them into magnitudes that do coexist and are homogeneous, and afterwards reducing them back to their original form.

But, perhaps, the fact that perfect quantitative reasoning deals exclusively with intuitions of the coextension of coexistent magnitudes that are connatural, will be most clearly seen when it is remarked that the intuitions of coextension, of coexistence, and of connature, are the sole perfectly definite intuitions of which we are capable. Whilst, on applying two equal lines together, we can perceive with precision that they are equal; we cannot, if one is greater than the other, perceive, with like precision, how much greater it is: and our only mode of precisely determining this, is to divide both into small *equal* divisions, of which the greater contains so many, and the less so many: that is—we have to fall back upon the intuition of coextension. Again, whilst we can perceive with the greatest exactness that two things coexist, we cannot, when one thing follows another, perceive with like exactness the interval of time between them: and our only way of definitely ascertaining this, is by means of a scale of time made up of coextensive units of space. Once more, we can recognize with perfect definiteness, the equality of nature of those things which admit of quantitative comparison. That straight lines are homogeneous, and can stand to each other in relations of greater and less, though they cannot so stand to areas or

cubic spaces; that areas are connatural with areas, and cubic spaces with cubic spaces; that such and such are magnitudes of force, and such and such are magnitudes of time—these are intuitions that have as high a degree of accuracy as the foregoing ones—a degree of accuracy which our intelligence cannot exceed. Beyond these three orders of intuitions, however, we have none but what are more or less indefinite. All our perceptions of degree and quality in sound, colour, taste, smell; of amount in weight and heat; of duration; of velocity; are in themselves inexact. Now, as we know that by quantitative reasoning of the higher orders, perfectly definite results are reached; it follows that the intuitions out of which it is built must be exclusively those of coexistence, connature and coextension: an inference which will be confirmed on calling to mind that in any case of imperfect quantitative reasoning, some other species of intuition is palpably involved.

And here, with a view of showing the various combinations into which these intuitions enter, and also with a view of exhibiting sundry facts not yet noticed, it will be well to group, in their ascending order, the successive forms which quantitative reasoning assumes: such repetition as will be unavoidable, being, I think, justified by the completer comprehension to be given, by presenting the phenomena in their genesis and their totality.

§ 28. The intuition underlying all quantitative reasoning is that of the equality of two magnitudes. Now, the immediate consciousness that—

$$A = B$$

implies—first, that A and B shall be coexistent; for otherwise, they cannot be so presented to consciousness as to allow of a direct recognition of their equality—second, that they shall be magnitudes of like kind, that is, connatural or homogeneous; for if one be a length and the other an area, no quantitative relation can exist between them—third, that they shall not be

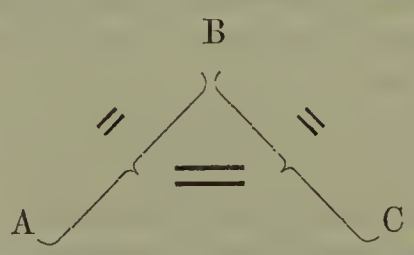
any homogeneous magnitudes, but they shall be magnitudes of linear extension; seeing that these alone admit of that perfect juxtaposition by which exact equality must be determined—these alone permit their equality to be tested by seeing whether it will merge into identity, as two equal mathematical lines placed one upon the other do—these alone exhibit that species of coexistence which can lapse into single existence: and thus the primordial quantitative idea, unites the intuitions of coextension and coexistence in their most perfect forms.

To recognize the negation of this equality—to perceive that A is unequal to B—or, more explicitly, to perceive either that—

$$A > B, \quad \text{or} \quad A < B$$

involves no such stringent conditions. It is true that, as before, A and B must be connatural magnitudes. But it is no longer necessary that they should be coexistent; nor that they should be magnitudes of linear extension. Provided the superiority or inferiority of A to B is considerable, it can be known in the absence of one or both; and can be known when they are magnitudes of bulk, weight, area, time, velocity, &c.

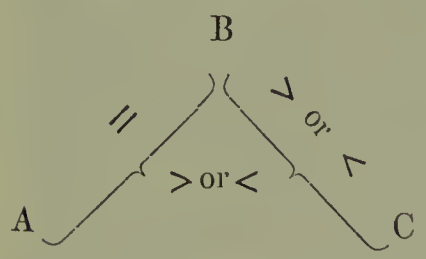
The simplest act of quantitative reasoning, which neither of these intuitions exhibits when standing alone, arises when the two are co-ordinated in a compound intuition; or when either of them is so co-ordinated with another of its own kind. When, by uniting two of the first intuitions thus—

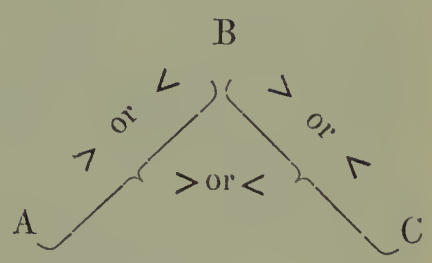


we recognize the equality of A and C; it is requisite, as before, that if the two equalities are to be known immediately, the magnitudes shall be those of linear extension, though, if the equalities have been mediately determined, the magnitudes may

be any other that are homogeneous; but it is no longer necessary that all of them shall coexist. At one time A must have coexisted with B; and at one time B must have coexisted with C; but the intuitions of their equalities having once been achieved, either at the same or separate times, it results from the ability which we have to remember a specific relation with perfect exactness, that we can, at any subsequent time, recognize, the equality of the relations A to B and B to C, and the consequent equality of A and C; though part, or even all, of the magnitudes have ceased to exist.

By uniting the first and second intuitions, and by uniting the second with another of its own kind, we obtain the two compound intuitions, formulated as follows:—





In the first of these cases it is requisite, when the relations are immediately established, that the magnitudes be linear; but not so if the equality of A and B has been indirectly established: and whilst A and B must have coexisted, it is not necessary that B and C should have done so. In the second case the magnitudes need not be linear; but, if the inequalities are considerable, may be of any order. Further, it would at first sight appear that they need none of them be coexistent. But this is not true; for if the superiority or inferiority of A to B and of B to C be so great that it can be perceived by comparing the remembrances of them, then the superiority or inferiority of A to C can be similarly perceived, without the intermediation of B; and the reasoning is superfluous. The only cases to which this formula applies, are those in which the inequalities are so moderate, that direct comparison is required for the discernment of them: whence it follows that, as in the third

formula, each pair of magnitudes must have been at one time coexistent. And in strictness this consideration applies also to the fourth formula.

The next complication, and the one which characterizes all quantitative reasonings save these simplest and least important kinds just exemplified, is that which arises when, in place of conjoined relations, we have to deal with disjoined relations—when the compared relations instead of having one term in common have no term in common. Wherever this happens—wherever we have four magnitudes instead of three, sundry new laws come into force: the most important of which is, that the magnitudes need no longer be all of the same order. In every one of the foregoing cases, it will be observed that while the intuition of coexistence is sometimes not immediately involved but only mediately so, even where the judgment reached is perfectly quantitative—while, where the judgment is imperfectly quantitative, the intuition of coextension is not involved, save as the correlative of non-coextension—the intuition that *is* uniformly involved is that of the connature of the magnitudes, their homogeneity, their sameness in kind. Without this, no one of the judgments given is possible. But with disjoined relations it is otherwise. The four magnitudes may be all homogeneous; or they may be homogeneous only in pairs, either as taken in succession or alternately. Let us consider the resulting formulæ.

When all the magnitudes are homogeneous we have for the first group of cases the symbol

$$\left.\begin{matrix} A \\ \| \\ B \end{matrix}\right\} = \left\{\begin{matrix} A' \\ \| \\ B' \end{matrix}\right.$$

in which each of the disjoined relations is one of equality, and the second is some transformation of the first. This, as

before shown, represents the mental act taken in every step of an equation; and stands for the several axioms—When equals are added to, subtracted from, multiplied by, or divided by, equals, the results are equal. For the second group of cases we have the symbol

$$\left.\begin{matrix} A \\ : \\ B \end{matrix}\right\} = \left\{\begin{matrix} C \\ : \\ D \end{matrix}\right.$$

in which each of the relations is one of inequality. This comprehends all the cases of proportion: whether they be the numerical ones in which the degrees of inequality are definitely expressed; or the geometrical ones (as those subsisting between the sides of similar triangles) in which the degrees of inequality, though known to be alike, are not definitely expressed. For the third group of cases, forming the antithesis to the two preceding groups, and being but imperfectly quantitative, we have the symbol

$$\left.\begin{matrix} A \\ : \\ B \end{matrix}\right\} > \text{or} < \left\{\begin{matrix} C \\ : \\ D \end{matrix}\right.$$

which represents such general truths as that if equals be taken from unequals the remainders are more unequal; that if to equals unequals be added, the sums are unequal; and so forth: and which also stands for the instances in which two ratios differ so widely, that their inequality is at once recognized. It needs only to be further remarked respecting these three groups of cases in which the magnitudes are all homogeneous, that the equality or inequality predicated between the two pairs, always refers directly or indirectly to the

space-relations of their components, and not to their time-relations.

Passing to the other disjunctive class, in which the several magnitudes are not all homogeneous, we find that the equality predicated between the relations may refer either to comparative extension or comparative existence. The first group of them, which may be symbolized thus:—

$$\left.\begin{matrix} A \\ : \\ B \end{matrix}\right\} = \left\{\begin{matrix} c \\ : \\ d \end{matrix}\right.$$

so as to indicate the fact that the magnitudes of the first relation are of one species, whilst those of the second relation are of another species, comprehends cases in which one line is to another line as one area to another area; or a bulk to a bulk, as a weight to a weight—cases like those in which it is seen that triangles of the same altitude are to one another as their bases; or that the amounts of two attractions are to each other inversely as the squares of the distances from the attracting body. Here it is manifest that though the first pair of magnitudes differs in kind from the second pair, yet the antecedent and consequent of the one, bear to each other the same quantitative relation as those of the other; and hence the possibility of ratiocination. The second group of cases is that in which each relation consists of two heterogeneous magnitudes, as a line and an angle; but in which the two antecedents are of the same nature, and the two consequents are of the same nature. It may be formulated thus:—

$$\left.\begin{matrix} A \\ : \\ b \end{matrix}\right\} = \left\{\begin{matrix} C \\ : \\ d \end{matrix}\right.$$

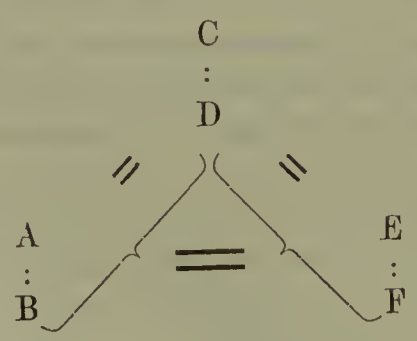
Here, neither of the compared relations can be a quantitative one: seeing that in neither do the components possess that connature without which relative magnitude cannot be predicated. Hence the two relations can be equal only in respect of the *coexistence* of their elements; and, as it would seem, considerations of quantity are no longer involved. But though, under the conditions here stated, the reasoning merges into that inferior species remaining to be treated of in the next chapter; there are other conditions under which this form represents reasoning that is truly quantitative: namely, when the coexistence holds only in virtue of certain defined quantitative relations, by which the heterogeneous magnitudes are indirectly bound together. Thus, when the theorem—"The greater side of every triangle has the greater angle opposite to it," is quoted in the proof of a subsequent theorem, the act of thought implied is of the kind above symbolized. The greater side (A) of a triangle, has been found to stand in a relation of coexistence with the greater angle (*b*); and in some other triangle the greater side (C) and greater angle (*d*) are perceived to stand in the *same* or an *equal* relation: but this relation is not simply that of coexistence; it is coexistence in certain respective positions: and though there can be no *direct* quantitative relation between a side and an angle, yet, by being contained between the two lesser sides, the greater angle is put in *indirect* quantitative relation with the greater side. It may be questioned, however, whether in this, as in the innumerable like cases that occur in geometrical reasoning, A, *b*, C, and *d* should not be severally regarded rather as relations between magnitudes, than as magnitudes themselves. To elucidate this question, let us consider the theorem—"The angle in a semicircle is a right angle." Here the word "semicircle" denotes definitely quantitative relations—a curve, all parts of which are *equi*distant from a given point, and whose extremities are joined by a straight line passing through that point: the words "angle in a semicircle" denote further quantitative relations: and the thing asserted is, that along with this

group of quantitative relations coexists that other quantitative relation which the term "right angle" denotes between two lines containing it. Taking this view, the reasoning will stand thus :—

DEMONSTRATED CASE.				ANY OTHER CASE.	
(The relations constituting the angle in this semicircle)	A			C	(The relations constituting the angle in that semicircle)
(Coexist with)	:	=		:	(Coexist with)
(The relations constituting a right angle.)	*b*			*d*	(The relations constituting a right angle.)

And this seems to be the more correct analysis of those kinds of quantitative reasoning, in which the antecedents are not homogeneous with the consequents.

The only further complication needing consideration here, is the one arising when, instead of *two* equal relations, we have to deal with *three*. As, from that first simple intuition in which two magnitudes are recognized as equal, we passed to the union of two such intuitions into a compound one involving three magnitudes; so again, from the foregoing cases in which two relations are recognized as equal, we now pass, by a similar duplication, to the still more complex case in which three relations are involved. This brings us to the axiom—"Relations that are equal to the same relation, are equal to each other;" formulated, as we before saw after this fashion :—



In which symbol it will be seen that each pair of relations

is united in thought, after the same general manner as any of the pairs lately treated of. The various modifications of this form which result when the relations are unequal, it is unnecessary here to detail. And it is also unnecessary to go at length into those yet more complicated forms which result when this conjunctive arrangement is replaced by a disjunctive one—when, in place of three relations, we have to deal with four; as in the case of the axiom given at the outset (§ 17)—"Relations which are severally equal to certain other relations that are unequal to each other, are themselves unequal." The laws of the evolution have been sufficiently exemplified to render this, and the allied intuitions, readily comprehensible. All that needs further be done, is to point out how, by successive developments, we have progressed from a simple intuition of the equality or inequality of two magnitudes, to a highly complex intuition of the equality or inequality of relations between relations.

§ 29. And, now, having examined quantitative reasoning in its genesis, and found that, either mediately or immediately, it always involves, in their positive or negative forms, some or all of the ideas—sameness in the nature of its magnitudes; sameness in their quantity; sameness in their time of presentation to consciousness; and sameness in degree between relations of the same nature subsisting among them; it will be well, finally, to observe that we may recognise, *à priori*, the impossibility of carrying on any quantitative reasoning, save by intuitions of the equality or inequality of relations. It is the purpose of a quantitative argument to determine with definiteness the relative magnitudes of things. If these things stand to each other in such wise that their relative magnitudes are known by simple intuition, argument is not involved. There can be argument, therefore, only when they are so circumstanced as not to be directly comparable: whence it follows that their relative magnitudes, if determined at all, must be determined by the intermediation of magnitudes to which they are com-

parable. The unknown quantitative relation between A and E, can be ascertained only by means of some known quantitative relations between each of them and B, C, D; and it is the aim of every mathematical process to find such intermediate known relations, as will bring A and E into quantitative comparison. Now, no contemplation of magnitudes alone can do this. We might go on for ever considering B, C, and D, in their individual capacities, without making a step towards the desired end. Only by observing their modes of dependence can any progress be made. If A and E are in an unknown quantitative *relation,* which we desire to determine, we can determine it only as being equal or unequal to certain other *relations,* which we know mediately or immediately. There is no way, even of specifically expressing the relation, save by this means. The ascertaining what a thing *is* or *is not,* signifies the ascertaining what things it is like or not like—what class it belongs to. And when, not having previously known the relation of A to E, we say we have determined it, our meaning is, that we find it to be the same, or not the same, as some relation which is known. Hence it results, *à priori,* that the process of quantitative reasoning, must consist in the establishment of the equality or inequality of relations.

CHAPTER V.

PERFECT QUALITATIVE REASONING.

§ 30. THUS far we have dealt with reasoning which has for its fundamental ideas, coextension, coexistence, and connature; and which proceeds by establishing cointension* in degree, between relations connate in kind. We have now to consider a species of reasoning into which the idea of coextension does not enter; or of which it forms no necessary element: that, namely, by which we determine the coexistence or non-coexistence of things, attributes, or relations that are connatural with certain other things, attributes, or relations. It was pointed out that the intuitions of coextension, coexistence, and connature, are the only perfectly definite ones we are capable of; and the only ones, therefore, through which we can reach exact conclusions. One class of these conclusions in which the *quantity* of certain existences of determinate quality is predicated, has been examined: we have now to examine a class in which the thing predicated is the *quality* of certain determinate existences; or the existence of certain determinate qualities.

The last chapter incidentally exhibited the near connection

* The words *tense*, *tension*, *intense*, *intension*, are already in use. *Intension* being synonymous with *intensity*, *cointension* will be synonymous with *cointensity*; and is here used instead of it to express the parallelism with *coextension*. The propriety of calling relations more or less *intense*, according to the contrast between their terms, will perhaps not be at first sight apparent. All quantitative relations, however, save those of equality, involving the idea of *contrast*—the relation of 5 : 1 being called greater than the relation of 2 : 1, because the contrast between 5 and 1 is greater than the contrast between 2 and 1—and contrast being habitually spoken of as *strong* or *weak*; as *forcible*, as *intense*; the word *intension* seems the only available one to express the *degree* of any relation as distinguished from its *kind*. And *cointension* is consequently here chosen, to indicate the equality of relations in respect of the contrast between their terms.

between these kinds of reasoning. It was shown, that when two compared relations severally consist of heterogeneous magnitudes admitting of no quantitative comparison, the two relations can be considered equal, only in respect to the coexistence of the components of each. It was shown that many geometrical theorems simulate this form; expressed by the symbol

$$\left.\begin{matrix} A \\ \\ : \\ \\ b \end{matrix}\right\} = \left\{\begin{matrix} C \\ \\ : \\ \\ d \end{matrix}\right.$$

the fact predicated being the coexistence of C and *d*, standing in the same relation as A and *b*, which were proved coexistent; (say the equiangularity and equilateralness of a triangle.) As was pointed out, however, the terms of each relation are, in these cases, not really heterogeneous magnitudes; but heterogeneous relations amongst magnitudes, having indirect, but definite quantitative connections. But when the terms of each relation are simple heterogeneous magnitudes, or heterogeneous groups of relations having no implied quantitative connections, then we pass to the order of reasoning now to be treated of; in which equality is asserted of two relations that are alike in the nature of their terms, and in the coexistence of each antecedent with its own consequent.

Before going on to particularize, it will be well to meet the objection that may be raised to the use of the word *equality* in the sense here given to it. Commonly we apply it only to attributes. We speak of equal lengths, breadths, areas, capacities; equal times, weights, velocities, momenta; equal temperatures, sounds, colours, degrees of hardness; and we speak of equal ratios or relations, when the terms are magnitudes; but we do not speak of relations of coexistence as equal. Here, however, we are dealing, not with words in their conven-

tional applications, but with the mental acts which words mark; and these, when they are of essentially the same character, may legitimately be indicated by the same terms. The true interpretation of equality is *indistinguishableness*. Colours, and sounds, and weights, and sizes, we call equal when no differences can be discerned between them. We assert the equality of two ratios—two relations of magnitude, when the contrast in amount between the first antecedent and its consequent, cannot be distinguished from the contrast between the second antecedent and its consequent. And, similarly, we may assert the equality of two relations of existence, when the one does not differ from the other in respect of time—when each is a relation of coexistence. As two relations of coextension are properly considered equal, though each of them consists of magnitudes that are unlike in everything but length; so, in a more limited sense, two relations of coexistence may properly be considered equal, though the elements of each are unlike in everything but the period of their presentation to consciousness. Or, to put the matter in an *à priori* form—All things whatever stand to each other in some relation of time. Every phenomenon, when considered in connection with any other, must be cognized either as occurring before it, as being simultaneous with it, or as occurring after it. But all objects of thought, and, amongst others, relations of time, admit of being compared, and their likeness or unlikeness recognized. The time-relation of events that occur simultaneously, is manifestly different from the time-relation of events that occur one after the other. Two sequences are alike in so far as they are sequences; and each of them is unlike a coexistence. Hence, if there are time-relations so completely alike as to be indistinguishable, they may properly be called *equal*. Such time-relations we have in all coexistences: and thus, when, as in the case of two attributes that invariably coexist, we, in any new case, know that where we see the one we shall find the other; it may as truly be said that the mental act involved, is a recognition of the equality of two

relations, as when, in similar triangles of which two homologous sides are known, we infer the area of one triangle from that of the other.

§ 31. Reasonings of this order, in which the thing predicated is not the quantity of certain existences, but either, on the one hand, the existence or non-existence of certain attributes, or group of attributes, or, on the other hand, the simultaneity, or non-simultaneity, of certain changes, or groups of changes — reasonings which, instead of contemplating *both* space-relations and time-relations, contemplate time-relations only—exhibit, in a large class of cases, that same necessity often ascribed exclusively to quantitative reasonings. This class of cases is divisible into two sub-classes: the one including disjoined relations, and the other conjoined relations—the one always involving four phenomena, and the other only three. The first of these sub-classes—represented by the formula last given, and, like geometrical reasoning, predicating necessary coexistence, but, unlike it, saying nothing of coextension—includes that infinitude of cases in which, from certain observed attributes of objects, we infer the presence of certain other attributes that are inseparable from them. When, on feeling pressure against an outstretched limb, we conclude that there is something before us having extension—when, on seeing one side of an object, we know that there is an opposite side—when, any one necessary property of body being perceived, another is foreseen; this order of reasoning is exemplified. Were it not that perpetual repetition has reduced these cognitions to what may be termed organic inferences, it would be at once seen they stand on an analogous footing with those in which the equilateralness of a triangle is known from its equiangularity, when the coexistence of these has once been recognized. Under another head we shall hereafter have occasion to consider these cases more closely. At present it merely concerns us to notice, that the mental act involved in each of them, is an intuition of the equality of two disjoined time-

relations—the one, a known generalized relation of invariable coexistence, ascertained by an infinity of experiences having no exception, and therefore conceived as a necessary relation; the other, a relation of coexistence, in which one term is not perceived, but is implied by the presence of the accompanying term. Or, to formulate an example:—

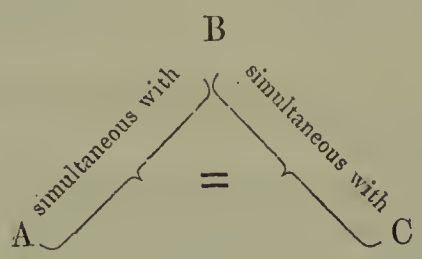
(Tangible substance)	A		a	(This mass of rope)
(Universally or necessarily coexists with)	:	=	:	(Coexists with)
(Limiting surfaces)	*B*		*b*	(Two ends which uncoiling it will disclose.)

And similarly in all cases of necessary attributes as distinguished from contingent ones.*

Of that subdivision of perfect qualitative reasoning which proceeds by recognizing the equality or inequality of conjoined relations, the examples are not very abundant. The fact predicated in them is, either the coexistence or non-coexistence of certain things, as determined by their known relations to some third thing; or else the simultaneity or non-simultaneity of certain events, as determined by their known relations to some third event. If, of two persons together passing the door of a building, the one observes a barrel of gunpowder, and the other a boy with a light in his hand, it is clear that, on immediately hearing an explosion, the adjacent coexistence of the light with the gunpowder is inferable from the facts that the one observed

* The choice of letters in this formula may need explanation. By using capitals in the first relation and small letters in the second, I intend to signify, on the one hand, the general or class relation, and, on the other, the particular relation contemplated. Letters of the same names are used, to match the fact that the antecedents are homogeneous with the antecedents, and the consequents with the consequents. And the use of roman letters for the antecedents and italic letters for the consequents, conversely implies that the antecedents differ in nature from the consequents—that the two are heterogeneous.

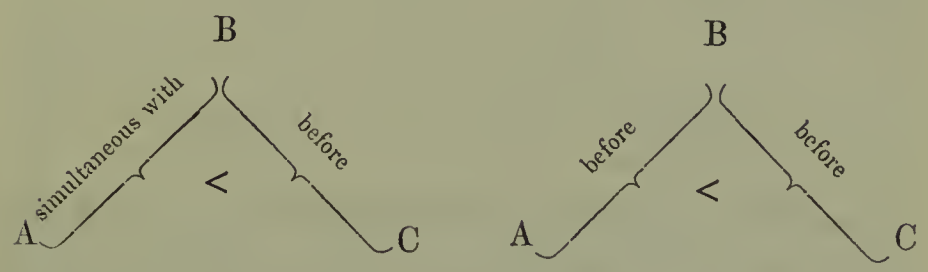
the adjacent coexistence of the light and the building, and the other the adjacent coexistence of the gunpowder and the building. If again, certain two other persons both heard the explosion, and, on comparing notes, found that each was setting out to meet the other at the moment of its occurrence; it is a necessary inference that they set out at the same time. These two classes of cases, dealing respectively with coexistent or non-coexistent things, and with co-occurring or non-co-occurring changes, are so nearly allied, that it is needless to treat of them both. Confining our attention to the latter class, we may represent the subdivision of it above exemplified, thus:—



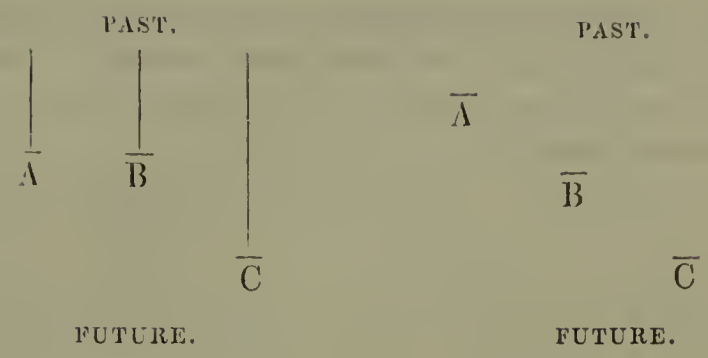
In this symbol the letters stand, not for objects, but for events: the simultaneity of A and C, being recognized by an intuition analogous to that by which their equality would be recognized, were they magnitudes both equal to a third.

The antithetical group of cases in which, of three events, the first and second being known to occur simultaneously, and the second and third being known to occur non-simultaneously, it is inferred that the first does not occur simultaneously with the third, needs not to be dealt with in detail. But it will be well to notice the more specific cases in which something more than simple non-simultaneity is predicated: those namely, in which it is inferred that one event preceded or succeeded a certain other event. Thus, if A and B go in company to a public meeting; and B on coming away meets C entering the door; then A, on afterwards hearing of this, knows that he was there before C: or if, supposing them all to go separately, C on arriving finds B already present; and B tells him that on

his (B's) arrival he found A present; then, though he should not see him, C knows that A was there before himself. Using the letters to stand for the events (not the persons), these cases may be represented thus :—



It is unnecessary to detail the possible modifications of these; or to argue at length that the intuitions must be essentially of the kind thus symbolized; for the cases are so obviously analogous to those previously treated of, in which the relations of two unequal magnitudes are known by the intermediation of a third (§ 24), that the explanation there given may, with a change of terms, be used here. All that it is requisite to observe is the fact, which this analogy itself suggests, that the reasoning exemplified by these last cases is, in a vague sense, quantitative. So long as only coexistence or non-coexistence, simultaneity or non-simultaneity, is the thing predicated, *quantity* of time can scarcely be said to be involved. But when the ideas *before* and *after* enter into the question, there would seem to be a mental comparison of periods; as measured from some common point in time. Particular occurrences in the general stream of events are relatively fixed by means of their respective relations to the past—are regarded as farther, or not so far, down the current of time; and can only be thus regarded by comparing the respective intervals between them and occurrences gone by. Whether, as in the first of the following figures, we represent each of the events A, B, and C, as the terminus to its own particular line of causation; or, whether, as in the second, we represent them simply as unconnected occurrences,—



—it is equally manifest that in determining the unknown relation of A and C, by means of their known relations to B, it is necessary to conceive all their times of occurrence as measured from some past datum—to compare the lengths of these times; and to recognize the inferiority of the length A to the length C, by means of the known relations they respectively bear to the length B. Where this datum is, matters not: for the respective periods measured from it, will retain their several relations of equality, inferiority, or superiority, however far back, or however near it is placed: and hence, perhaps, the reason why we form no definite conception of it. The best proof, however, that the process of thought is as here described, is obtained, when, from these vaguely-quantitative predications expressed by the words *before* and *after*, we pass to those definitely-quantitative ones achieved by using space as a measure of time—when we pass to cases in which, by our clocks, we determine *how much* before or after. For when, on hearing that one event occurred at four and another at five, we know that the one was an hour later than the other; we really recognize their relation in time, by means of their respective relations to twelve o'clock—the datum from which their distances are measured. Similarly with the lapse of time between any two historical events; which we determine by severally referring them to the commencement of the Christian era. And if, to determine specifically the respective positions in time of two events not directly comparable, we habitually compare their distances from some point in the past; it can scarcely be

doubted that when we merely determine their positions generally, as before or after, the process gone through is, though vague and almost unconscious, of the same essential nature.

But, whatever may be the detailed analysis of this mental act—and it is not an easy one—the act must necessarily consist in an intuition of the equality or inequality of two relations. If the events A and C stand in just the same time-relation to an event B; or, more strictly—if their time-relations to it are *equal;* then the cognition that they are simultaneous is involved: they cannot be thought as both occurring at the same time with C; or at equal intervals before it; or after it; without being thought as simultaneous. Conversely, if the events A and C are known to stand in different time-relations to the event B—if their time-relations to it are *unequal;* then the cognition of their non-simultaneity is involved. Whence it unavoidably follows, that when the difference of the time-relations is expressed more specifically—when the terms *before* and *after* are used; the intuition must be essentially of the same character: be the mode in which the comparison of relations is effected, what it may.

§ 32. It seems to me, that to this species of reasoning alone, are applicable the axioms which Mr. Mill considers as involved in the syllogism. If we include simultaneity in our idea of coexistence, it may be said that all the foregoing cases of conjunctive reasoning, severally involve one or other of the two general propositions—"Things which coexist with the same thing coexist with one another," and—"A thing which coexists with another thing, with which other a third thing does not coexist, is not coexistent with that third thing." But in no other ratiocinative acts, I think, than those above exemplified, are these self-evident truths implied.

That they cannot be the most general forms of the mental processes commonly formulated by the syllogism, will become manifest on considering that they refer positively or negatively to one time only; whereas, the syllogism, as involving in its

major premiss a more or less direct appeal to accumulated experience, refers to *two* times—to time present and time past. The axiom—"Things which coexist with the same thing coexist with each other," cannot, however often repeated, help us to any knowledge beyond that of the coexistence of an indefinite number of things; any more than the axiom,—"Things which are equal to the same thing are equal to each other," can, by multiplied application, do more than establish the equality of some series of magnitudes. But the act of thought which every syllogism attempts to represent, besides involving a cognition of the particular coexistence predicated in the conclusion; involves also, a cognition of those other coexistences which form the data for that conclusion: all of which coexistences may have long since ceased. The two terms of the coexistence predicated, may alone continue in being: the entities presenting parallel coexistences may have been every one annihilated: how, then, can the mental act by which the predication is effected, be formulated in an axiom which involves *three coexistent terms?*

The fact is, that Mr. Mill has here been misled by a verbal ambiguity of a kind, which he himself has previously pointed out, as one "against which scarcely any one is sufficiently on his guard." Towards the close of Chapter iii. of his Logic, he says:—"Resemblance, when it exists in the highest degree of all, amounting to undistinguishableness, is often called identity, and the two similar things are said to be the same * * * as when I say that the sight of any object gives me the *same* sensation or emotion to-day that it did yesterday, or the *same* which it gives to some other person. This is evidently an incorrect application of the word *same;* for the feeling which I had yesterday is gone, never to return; what I have to-day is another feeling, exactly like the former perhaps, but distinct from it; * * * * By a similar ambiguity we say, that two persons are ill of the *same* disease; that two persons hold the *same* office." Now, that the verbal confusion between identity and exact likeness, thus exemplified, has betrayed

Mr. Mill into the above erroneous formula, will, I think, become manifest, on examining the passage which serves to introduce that formula. At page 200 (3rd edition), he says :—

"The major premiss, which, as already remarked, is always universal, asserts, that all things which have a certain attribute (or attributes) have or have not along with it, a certain other attribute (or attributes). The minor premiss asserts that the thing or set of things which are the subject of that premiss, have *the first-mentioned attribute;* and the conclusion is, that they have (or that they have not) the second. Thus in our former example,—

All men are mortal,
Socrates is a man,
therefore
Socrates is mortal,

the subject and predicate of the major premiss are connotative terms, denoting objects and connoting attributes. The assertion in the major premiss is, that along with one of the two sets of attributes, we always find the other: that the attributes connoted by "man" never exist unless conjoined with the attribute called mortality. The assertion in the minor premiss is that the individual named Socrates possesses *the former attributes;* and it is concluded that he possesses also the attribute mortality."

Both in the general statement and in the example, I have italicised the words in which the misconception is more particularly implied. Let us confine our attention to the example. Here it will be observed, that in saying, "Socrates possesses *the former attributes,*" the literal meaning of the words, and the meaning Mr. Mill's axiom ascribes to them, is, that Socrates possesses attributes not *exactly like* those connoted by the word "man," but the *same* attributes. By this interpretation, and only by this interpretation, are the elements of the syllogism reducible to three—1st, the set of attributes possessed

by all men and by Socrates; 2nd, the mortality of other men; 3rd, the mortality of Socrates. But is it not clear that in asserting Socrates to possess the attributes possessed by other men—in calling the attributes which constitute him a man, the *same* as those by which men in general are distinguished; there is a misuse of words parallel to that involved in saying that two persons are ill of the *same* disease? Persons said to have the *same* disease, are persons presenting similar groups of special phenomena not presented by other persons. Objects said to have the *same* attributes (as those of humanity), are objects presenting similar groups of special phenomena not presented by other objects. And if the word *same* is improperly used in the one case, it must be improperly used in the other. This being admitted, it follows inevitably, that the elements of the syllogism cannot be reduced to less than four. (1). The set of attributes characterizing any or each of the before-known objects that are united into a certain class: which set of attributes must be represented in consciousness, either (plurally) as possessed by every sample of the class that can be remembered, or (singularly) as possessed by some one sample of it, figured to the mind as a type of the class; and which, therefore, cannot be considered as *less* than one, though it may be considered as *more*. (2). The particular attribute predicated in the major premiss, as always accompanying this set of attributes: and which, according as we are supposed to think of it as possessed by several remembered samples of the class, or by a typical sample, may be considered as many, or as one; but cannot be less than one. (3). The set of attributes presented by the individual (or sub-class) named in the minor premiss: which set of attributes being essentially like (not the same as) the first-named set of attributes, this individual is recognized as a member of the first-named class. (4). The particular attribute inferred, as accompanying this essentially like set of attributes. And if the elements of the syllogism cannot be reduced to less than *four*, it is manifest that the axiom—"Things which coexist with the same thing coexist with each

other," which comprehends only *three* things, cannot represent the mental act by which the elements of the syllogism are co-ordinated. Only to that limited class of conjunctive reasonings lately exemplified, can such an axiom apply.

§ 33. Returning from this parenthetical discussion, there has still to be noticed that further species of perfect qualitative reasoning, in which the thing predicated is some necessary relation of phenomena in succession. In a previous part of the chapter, we have considered cases of unconditional coexistence; and here we have to glance at cases of unconditional sequence. As in the first group, we were concerned only with those relations of coexistence of which the negations are inconceivable; so in the second, we are concerned with those relations of antecedence and sequence which it is impossible to think of as other than we know them. To take a case—If, on entering a room, I find that a chair which I had previously placed in one part of it, is now in another; it is a necessary conclusion that it has traversed the intervening space: it is inconceivable that it should have reached its present position, without having passed through positions intermediate between that and the original one: and further, it is a necessary conclusion that some agency (very probably, though not certainly, human) has produced this change of place: it is inconceivable that there should be this effect without a cause. Here we have nothing to do with the analyses of these inferences further than to observe, that, like the previous ones, they are reached by intuitions of the equality of relations. The relation between this effect as a consequent, and some force as an antecedent, is conceived as one with an infinity of such relations; differing in detail, but alike in presenting uniformity of succession. And similarly with the relation between changed position, and transit through space.

CHAPTER VI.

IMPERFECT QUALITATIVE REASONING.

§ 34. Though the line of demarcation between perfect and imperfect qualitative reasoning would seem to be tolerably precise—seeing that whilst the conclusions of the one are of the kind whose negations cannot be conceived, those of the other can have their negations conceived with greater or less difficulty—yet the approximation of the two is practically so close, that some of the second class may readily be mistaken for members of the first. These divisions, convenient, and, indeed, essential as they are, are most of them in some degree artificial. Just as in the last chapter we saw that the distinction between quantitative and qualitative reasoning can scarcely be maintained in cases where the thing predicated is antecedence or subsequence in time; so here, the transition from perfect to imperfect qualitative reasoning, is through cases in which the conclusions, if not absolutely necessary, are almost so. Thus the relation between visible and tangible attributes is such, that on receiving the ocular impressions representing an adjacent object, we cannot help concluding that an adjacent object exists, which, on putting out our hands towards it, will give them sensations of resistance; and there are doubtless many aboriginal minds by which no other conclusion is conceivable. But our experience of looking-glasses and of optical illusions, renders it just possible for us to imagine that where the appearance exists, there may exist no solid substance. Though, judging from the unhesitating confidence with which, from moment to moment, we act out cognitions of this order, they would seem to stand on the same footing with those lately exemplified, in which from the invariable coexistence of tangibility with limiting surfaces, we infer

that any particular object must have ends; yet the two classes are found to differ, when thus rigorously analysed. So, again, with cases like that incidentally quoted at the close of the last chapter, in which the mortality of a particular individual is inferred from the mortality of mankind in general. Certain as the inference appears, and next to impossible as it seems for any one to *believe* of himself, or of another, that he will not die; it is yet not only conceivable that death might be escaped, but history shows us that in times past it was even believable.

The various grades of imperfect qualitative reasoning—beginning with those in which the negation of the inference can be conceived only by the greatest effort; descending through those in which it can be conceived with less and less effort; and ending with those lowest cases of contingent reasoning in which it presents itself to the mind almost as readily as the opposite one—are discriminated from perfect qualitative reasoning, and from quantitative reasoning, by the peculiarity that the compared relations are no longer to be considered as *equal* or *unequal*, but as *like* or *unlike*. That complete indistinguishableness which characterizes the compared relations of definite necessary reasoning, is found only among the simple phenomena of number, space, time, force, —is not predicable of the relations subsisting among those comparatively complex phenomena whose dependencies cannot be known, or are not yet known, as necessary. The knowledge that the ratio, A : B, is equal to the ratio, $\frac{A}{2} : \frac{B}{2}$, is an exact intuition. The contrast in magnitude between A and B is perceived to be indistinguishable from that between half A and half B. The two relations not being each of them made up of sundry component relations, the comparison between them gives a result that is simple and precise. But when, from the general truth that motion is a constant antecedent of sound, we infer, on hearing a sound, that something has moved; or when, from human mortality in general, we infer the mortality of a par-

ticular individual; the compared relations cannot be called *equal*, but can only be called *like*. The established relation between sound, and motion as its antecedent, is not representable to the mind as one special relation; but as an average of many special relations varying in the amounts, qualities, and intervals of their antecedents and consequents: and hence the particular relation between the sound heard and the motion inferred, cannot be held *equal* to the general one; seeing that this lacks the definiteness implied by such a predication. Even when, from the nature of the sound, the character of the antecedent motion is known—when, from a loud crash, it is concluded that a heavy body has fallen; there is still only *likeness* in the compared relations, though it is a likeness that approaches nearer to equality: for though the repeatedly experienced relation between a loud crash and the fall of a heavy body, is far more specific than is the general relation between sound and motion; yet it is not so specific as that either the size or nature of the body can be known with any precision; as it could be were the compared relations *equal* in the true sense of the word. Similarly in the second case. Though the relation between life and death is such that we can with certainty say of any individual that he will die; yet we cannot with certainty say either the time or the manner. He may die to-morrow by accident; or next year by disease; or fifty years hence of old age. Whilst the generalization from which our conclusion is deduced, is specific in the respect that the phenomena of life are invariably followed by those of death; yet the infinity of cases included in the generalization differ more or less in every other respect than this fundamental one: and, consequently, as the particular relation which the conclusion recognizes, exactly parallels no particular foreknown relation; and has only one peculiarity in common with all foreknown relations of the same order; *likeness*, only, can be asserted of it, and not equality. Did we regard the relation between life and death in the abstract, as purely one of succession—could we exclude from it all consciousness of the

interval, so as to recognize no difference between the death of the infant and that of the centenarian—we might with propriety consider all cases of the relation as equal: but our inability to do this, necessitates the use of the more general word. Indeed, it needs but to observe the contrasted applications we commonly make of these words, to see the validity of the distinction. The things we habitually call equal, are either simple sensations or simple relations. We talk of *equal* lengths, breadths, and thicknesses; *equal* weights and forces; *equal* temperatures and degrees of light; *equal* times and velocities. When speaking accurately, we do not, in respect to any of these, use the word *like*, unless in the qualified form "*exactly alike*," which is synonymous with *equal*: nor, when the compared magnitudes of these kinds are almost, though not quite *equal*, do we allow ourselves to call them *like*, in virtue of their near approximation. Wherever the terms of the comparison are both elementary—have only one aspect under which they can be regarded; and can be specifically posited either as distinguishable or indistinguishable; we call them either *unequal* or *equal*. But when we pass to complex things, exhibiting at once the attributes, size, form, colour, weight, texture, hardness—things which, if equal in some particulars, are rarely if ever equal in all; and therefore rarely if ever indistinguishable—then we use the term *like*, to express, partly the approximate equality of the several attributes separately considered, and partly the grouping of them after a parallel manner in time and space. Similarly with the relations involved in reasoning. If simple, they are recognized as *equal* or *unequal*; if complex, as *like* or *unlike*.

§ 35. This premised, it will at once be seen that those cases of imperfect qualitative reasoning commonly given in Treatises on Logic, as illustrating the process of thought said to be expressed by the syllogism, severally exhibit intuitions of the likeness or unlikeness of relations. When, to quote a familiar case, it is said—"All horned animals are rumi-

nants; this is a horned animal; therefore this animal is a ruminant;" the mental act indicated is a cognition of the fact that the relation between particular attributes in this animal, is like the relation between homologous attributes in certain other animals; and may be symbolized thus:—

(The attributes constituting a horned animal)	A	is like	a	(The attributes constituting this a horned animal)
(Coexist with)	:		:	(Coexist with)
(The attributes constituting a ruminant animal.)	*B*		*b*	(The attributes constituting this a ruminant animal.)

That this formula—the relation between A and *B* is like the relation between a and *b*—substantially represents the logical intuition, will, from our present stand-point, be obvious. For it is manifest—first, that it is only in virtue of the perceived *likeness* between A and a—the group of attributes involved in the conception of a horned animal, and the group of attributes presented by this particular animal—that any inference can be valid, or can even be suggested: second, that the attributes implied by the term "ruminant," can be known only as previously observed or described; and that the predication of these as possessed by the animal under remark, is the predication of attributes *like* certain foreknown attributes: and, third, that there is no assignable reason why, in this particular case, a relation of coexistence should be predicated between these attributes and those signified by the words "horned animal," unless as being *like* certain relations of coexistence previously known: nor, indeed, could the predication otherwise have any probability, much less certainty. Or, to state the case with greater precision—Observe, first, that as the unseen attribute predicated, cannot, on the one hand, be supposed to enter the mind, save in some relation to its subject; and that as, on the other hand, the relation cannot be thought of without the subject and the predicated attribute being involved as its terms; it follows that the intuition, which the inference

expresses, must be one in which subject, predicate, and the relation between them are jointly represented. Observe next, that while subject and predicate are separately conceivable things, the relation between them cannot be conceived without involving them both; whence it follows that only by thinking of the relation can the elements of the intuition be combined in the requisite manner. And now observe, under what form this relation must be thought. Clearly, since the subject is recognized as *like* certain others with which it is classed; and since the attribute predicated is conceived as *like* an attribute possessed by other members of the class; and since the relation between the subject and the predicated attribute is proved, by the truth of the predication, to be *like* the relation subsisting in other members of the class; it must be by recognizing the relation as *like* certain foreknown relations, that the conclusion is reached.

This view of the matter will be further elucidated and confirmed, by contemplating the essential parallelism subsisting between the species of reasoning above described, and that species of mathematical reasoning which is confessedly carried on by comparison of relations. The unknown fact predicated in a syllogism, is perfectly analogous to the unknown fourth term in a proportion. Let us take cases.

SYLLOGISM.	A (the fermentation of wort)	:	B (the evolution of carbonic acid)	is like	a (the fermentation in this vat of wort.)	:	b ( )	
PROPORTION.	A (the walking a mile)	:	B (the lapse of fifteen minutes)	equals	a (the walking this quarter of a mile)	:	b ( )	

In each of these acts of ratiocination (mark the word) the fourth term, *b*, represents the thing inferred: and seeing, not only that it is similarly related to its data in the two cases, but that the data stand in like relations to each other; the essen-

tial parallelism of the mental processes will be manifest. No doubt they have their differences: but an examination of these will serve but to show their fundamental agreement. Thus, the fact that the predication in the first is qualitative, whilst in the second it is quantitative, though true in the main, and important as a general distinction, is not true in any literal or absolute sense. For, if strictly analyzed, both are found qualitative, and both in some degree quantitative. A glance at the forms in which the two inferences present themselves to the mind, will render this obvious. The first (that carbonic acid is being evolved) is, in the main, and as verbally expressed, merely qualitative—refers to the *nature* of a certain process and a certain product; and the second (that a specified portion of time will elapse), though distinguishable as especially quantitative, is by implication qualitative also; seeing that not only is a magnitude predicated, but a magnitude of *time*: the thing inferred is defined alike in *nature* and *amount*. As thus regarded, then, the first inference is qualitative; and the second both qualitative and quantitative. If now, we examine the two inferences still more closely, and, neglecting the words in which they are expressed, consider the mental states those words describe; we shall see a still nearer approximation. For though the first inference as verbally rendered (carbonic acid is being evolved) is in no respect quantitative; yet the idea so rendered, is constantly accompanied by an idea of quantity, more or less definite. The experiences by which it is known that fermenting wort evolves carbonic acid, are accompanied by experiences of the quantity evolved; and vague as these may be, they are yet such that when the brewer predicates a certain vat of fermenting wort to contain carbonic acid, part of the predication, as present to his consciousness, is an idea of some quantity—more, certainly, than a cubic foot; less, certainly, than the total capacity of the vat: and this quantity is intuitively thought of as in some ratio to the quantity of wort. Again, in the second case, though the inference as verbally rendered (the lapse of three minutes and three-quarters) is

specifically quantitative; yet the idea so rendered, *if examined in its primitive form,* is not specifically quantitative; but only vaguely quantitative. A man who has walked a mile in fifteen minutes, and, observing that he has a quarter of a mile still to go, infers the time it will take to reach his destination; does not primarily infer *three minutes and three-quarters;* but primarily infers *a short time*—a time indefinitely conceived as certainly less than ten minutes, and certainly more than one. True, he can afterwards, by a process based upon the perceived equality of the relations between time and distance, calculate this time specifically. But, as it will not be contended that he can reach the specific time without calculation; and as it must be admitted that before making the calculation he has an approximate notion of the period he seeks to determine; it must be confessed that though his ultimate inference is definitely quantitative, his original one is but indefinitely quantitative. The two inferences, then, as at first formed, are alike in being qualitative and indefinitely quantitative; and they differ simply in this—that whilst in the one, the quantitative element is neglected as incapable of development, it is, in the other, evolved into a specific form. Seeing, then, that the parallelism between them is so close, it cannot be questioned that as the last is reached by an intuition of the equality of two relations, so the first is reached by an intuition of the likeness of the two relations.*

It is unnecessary here to give any illustration or analysis of that species of so-called syllogistic reasoning by which negative inferences are reached; and which differs from the fore-

* The foregoing analysis, in which it is incidentally pointed out that every act of specifically quantitative reasoning is preceded by a provisional act of qualitative reasoning (which is only potentially quantitative), suggests an interesting analogy between these particular processes of reasoning, and the general evolution of reasoning. For, not only is it true that, in the course of civilization, qualitative reasoning precedes quantitative reasoning; not only is it true that, in the growth of the individual mind, the progress must be through the qualitative to the quantitative; but it is also true, as we here find, that every act of quantitative reasoning is qualitative in its initial stage.

going species simply in this; that the fact recognized is not the likeness, but the unlikeness, of two compared relations. Nor is it requisite to give any detailed interpretation of the different forms and modes of the syllogism; which obviously depend, partly upon the order in which the terms of the two relations are contemplated, and partly upon the extent to which the relations hold, as being either universal or partial. All that properly falls within a psychological analysis like the present, is, an explanation of the general nature of the mental process involved. To consider the various possible modifications of this process, would carry us further than is desirable into the province of Logic.

Neither will it be needful to exemplify that compound qualitative reasoning, which occurs in all cases where an inference is reached, not by a single intuition of the likeness or unlikeness of relations, but by a connected series of such intuitions. Analogous as such cases are to those of compound quantitative reasoning, examined in previous chapters; and, like them, consisting of successive inferences that are sometimes severally perfect, and sometimes only part of them perfect; it will suffice to refer the reader to §§ 22, 24, for the general type, and to his own imagination, for instances.

All that it seems desirable to notice, before leaving that division of imperfect qualitative reasoning which proceeds from generals to particulars, is the fact, that, by an easy transition, we pass from the ordinary so-called syllogistic reasoning, to what is commonly known as reasoning by analogy; this last differing from the first simply in the much smaller degree of likeness which the terms of the inferred relation bear to those of the known relations it is supposed to parallel. In the syllogism as ordinarily exemplified, it is to be observed, not only that the objects classed together as the subject of the major premiss, have usually a great number of attributes in common, besides the one more particularly predicated of them; but that the individual or sub-class which the minor premiss names, has also a great number of attributes in common with

this class of objects: in virtue of which extensive community of attributes it is, that the inferred attribute is asserted. Thus, when it is argued—"All men are mortal: therefore this man is mortal;" it is clear that the individual indicated, and all the individuals of the class to which he is tacitly referred, exhibit a high degree of similarity. Though they differ in colour, stature, bulk, in minor peculiarities of form, and in their mental manifestations; yet they are alike in such a great number of leading characteristics, that there is no hesitation in grouping them together. When, again, it is argued—"All horned animals are ruminants: therefore, this horned animal is a ruminant;" we see that though the sub-classes—such as oxen, deer, and goats—which are included in the class horned animals, differ considerably in certain respects; and though the particular horned animal remarked upon, as the ibex, differs very obviously from all of them; yet they have sundry traits in common, besides having horns. If, taking a wider case, we reason that as all mammals are warm-blooded, this mammal is warm-blooded, it will be remarked that the class—including as it does, whales, mice, tigers, men, rabbits, elephants—is far more heterogeneous. If, once more, we infer the vertebrate structure of a particular quadruped from the general fact that all quadrupeds are vertebrate, the class, as including most reptiles, is more heterogeneous still. And the heterogeneity approaches its extreme, when we draw inferences from the propositions that all animals contain nitrogen, and that all organisms are developed from fertilized germs. But now let it be noticed that, in these latter cases, in which the objects grouped together have so many points of difference, the probability of the conclusion come to, depends upon the previous establishment of the asserted relation, not simply throughout one, or a few, of the sub-classes thus grouped, but throughout a great variety of those sub-classes. Had only oxen and goats been found ruminant, the presumption that any other species of horned animal was ruminant, would be but weak. The warm-bloodedness of a new kind of mammal, would be but

doubtfully inferable, if only a dozen or a score other kinds were known to be warm-blooded; no matter how many thousands of each kind had been tested. If the possession of a spine had been proved to coexist with the possession of four legs, only in every species of quadruped inhabiting this country, it would be hazardous to assert of any and all four-legged creatures found in other parts of the globe, that they had spines. In each of these cases, the reasoning, whilst yet the general fact was unestablished, would be merely analogical; and would be so recognized. Take a parallel instance. The elephant differs from most mammals in having the teats placed between the fore limbs; and also in the structure of the hind limbs, which have their bones so proportioned, that where there is usually a joint bending backwards, there is, in the elephant, a joint bending forwards. In both these peculiarities, however, the elephant is like man and the quadrumana; whilst at the same time it approaches them in sagacity, more nearly than any other creature does. If now, there were discovered some new animal organized after the same fashion, and unusual marks of intelligence were to be expected from it, the expectation would imply what we call an inference from analogy; and vague as this analogy would be, it would not be more vague than that which induced the expectation that other horned animals ruminated, whilst yet rumination had been observed only in oxen, goats, and deer. Add to which, that just as, when to oxen, goats, and deer, were added numerous other species in which the like relation subsisted, the basis of deduction was so far enlarged as to give the inferred rumination of a new horned animal, something more than analogical probability; so, were the relation between special intelligence and physical characteristics above described, found in a hundred different kinds of mammalia, the inference that a mammal possessing these physical characteristics was intelligent, would be an ordinary deduction; and might serve logicians as an example of syllogistic reasoning, equally well with the preceding one. Thus, premising that in the syllogism the word

"all" means—all that are known (and it can never mean more), it is clear that ordinary syllogistic deductions differ from analogical ones, simply in degree. If the subjects of the so-called major and minor premisses are considerably unlike, the conclusion that the relation observed in the first will be found in the last, is based on nothing but analogy; which is weak in proportion as the unlikeness is great: but if, everything else remaining the same, the class named in the major premiss has added to it class after class, each of which, though considerably unlike the rest, has a certain group of attributes in common with them, and with the subject of the minor premiss; then, in proportion as the number of such classes becomes great, does the conclusion that a relation subsisting in every one of them subsists in the subject of the minor premiss, approximate towards what we call deduction.

In an order of still more remote analogical reasoning, we find much unlikeness not only between the subjects, but between the predicates. Thus, to formulate an example:—

(The growth of an individual organism)	A	is like	A	(The growth of society)
(Is simultaneous with)	:		:	(Is simultaneous with)
(The subdivision of functions among its parts.)	B		B	(The division of labour among its members.)

In this case, the likeness in virtue of which society is referred to the class, organisms, is extremely distant; and there is not much apparent similarity between the progress of organic economy and that of industrial economy: so that the inference could be considered but little more than an idle fancy, were it not inductively confirmed by past and present history.

And now, not to overlook the bearing of these cases on the general argument, let it be remarked—First, that analogical reasoning is the antipodes of demonstrative reasoning, not only in its uncertainty, but also in the dissimilarity of the objects whose relations it recognizes: seeing that whilst, in

mathematical and other necessary inferences, the things dealt with have few attributes, and the relations among them are capable of accurate determination as *equal*, or exactly alike; and whilst, in the imperfect deductive reasoning lately treated of, the things dealt with have many attributes which, though severally differing in some degree, have so much in common, that most of their relations may properly be called *like;* in analogical reasoning the things dealt with, are, in many respects, conspicuously *unlike;* and the presumption that they are like in respect of some particular relation, becomes correspondingly feeble. Secondly, let it be remarked, that whilst ordinary class reasoning is, under one aspect, parallel to that species of mathematical reasoning, which recognizes the equality between one relation of 2 : 3, and all other relations of 2 : 3; reasoning by analogy is, under the same aspect, parallel to that species of mathematical reasoning which recognizes the equality between the relation 2 : 3 and the relation 6 : 9—an equality that is called a numerical analogy. And let it be remarked, in the third place, that as, in the case of analogical reasoning, the likeness of the relations is obviously the thing contemplated,—seeing that it would never occur to any one to consider society as an organism, unless from the perception that certain relations between the functions of its parts were like the relations between the functions of the parts constituting an animal—and as the most perfect mathematical reasoning, namely, that which deals with numbers, confessedly proceeds by intuitions of the equality or exact likeness of relations; we have yet further grounds for holding that all orders of reasoning which lie between these extremes, and which insensibly merge into both, are carried on by a similar mental process.

§ 36. From that species of imperfect qualitative reasoning, which proceeds from generals to particulars, we now pass to that antithetical species which proceeds from particulars to generals; in other words—to inductive reasoning. From our present stand-point, not only the fundamental differences, but

the fundamental similarities, of these kinds of reasoning become clearly apparent. Both are seen to be carried on by comparison of relations: and the contrast between them is seen to consist solely in the numerical preponderance of the premised relations in the one case, and of the inferred relations in the other. If the known relations grouped together as of the same kind, outnumber the unknown relations recognized as like them; the reasoning is deductive: if the reverse; it is inductive. In the accompanying formula, arranged with a view of exhibiting this contrast, the whole group of attributes, in virtue of which an object is known as such or such, are symbolized by A or A or a, according as they are thought of as possessed by all, or some, or one; and for the particular attribute or set of attributes predicated as accompanying this group, the letter *B* or *B* or *b* is used, according as the subject of it is all, some, or one.

DEDUCTION.

$$\left.\begin{matrix} A \\ : \\ B \end{matrix}\right\} \text{is like} \left\{\begin{matrix} A \\ : \\ B \end{matrix}\right. \text{or is like} \left\{\begin{matrix} a \\ : \\ b \end{matrix}\right.$$

Class. Sub-class. Individual.

INDUCTION.

$$\left.\begin{matrix} a \\ : \\ b \end{matrix}\right\} \text{or} \left.\begin{matrix} A \\ : \\ B \end{matrix}\right\} \text{is like} \left\{\begin{matrix} A \\ : \\ B \end{matrix}\right.$$

Individual. Sub-class. Class.

Or, to give a specific illustration of each,—Like the general observed relation between living bodies and fertilized germs; is the relation between these infusoria and fertilized germs; or is the relation between this entozoon and a fertilized germ: and, conversely—Like the observed relation between the development of this plant and its progress from homogeneity to heterogeneity of structure; or like the observed relation between the development of those animals and their progress from homogeneity to heterogeneity of structure; is the general relation in all organisms between development and progress from homogeneity to heterogeneity of structure.

Some possible criticisms on this exposition may fitly be noticed. In the formula, as well as in the illustration of the inductive process, I have introduced, as it may appear merely to complete the antithesis, the generalization of a whole class of cases, from the observation of a single case—a generalization which seems manifestly illegitimate. To this objection there are two replies. In the first place, it is to be remembered that our immediate subject is not logic, but the nature of the reasoning process; and if, as will not be denied, many people are in the habit of founding a general conclusion upon a solitary instance—if, as must be admitted, the mental process by which they advance from data to inference is the same where the data are insufficient, as where they are sufficient; then, a general account of this mental process may properly include examples of this kind. The second reply is, that throughout a wide range of cases, such inductions are perfectly legitimate. When it has been demonstrated of a particular equilateral triangle that it is equiangular, it is forthwith inferred that all equilateral triangles are equiangular; and numberless general truths in mathematics are reached after this fashion. Hence, then, a formula for induction not only *may*, but *must* include the inference from the singular to the universal. A further criticism which will perhaps be passed, is, that in quoting as a specimen of deduction, the argument that infusoria have fertilized germs because living bodies in general have them, a very questionable sample of the process has been given; as is proved by the fact that there are still many by whom the inference is rejected. My answer is again twofold. It is beyond question that the majority of the deductions by which every-day life is guided, are of this imperfect order; and hence, whether valid or invalid, they cannot be excluded from an account of the deductive process. Further, I have chosen a case in which the conclusion is open to a possible doubt, with a view of implying that in all cases of contingent reasoning, the unknown relation predicated, can never possess anything more than a high degree of probability—a degree

proportionate to the frequency and uniformity of the parallel experiences.

This doctrine is, I am aware, quite at variance with that held by many logicians, and especially by Sir William Hamilton; who contends not simply that (irrespective of the distinction between necessary and contingent matter), there are both Deductions and Inductions in which the conclusion is absolutely necessitated by the premisses, but that all other Deductions and Inductions are extra-logical. To discuss this question at full length, would involve an undue divergence from our subject. Such brief criticisms only can be set down, as seem requisite for the defence of the opposite doctrine. Among general objections to Sir William Hamilton's argument (see "Discussions," pp. 156 to 166), may be noted the fact that he uses the word *same* in place of the word *like*, after a fashion equally ambiguous with that pointed out in the last chapter. Moreover, he employs the words *whole* and *parts* (to stand for a logical class and its constituent individuals) in a mode implying that in thinking of a whole we definitely think of *all* the contained parts—an assumption totally at variance with fact. No one, in arguing that because all men are mortal, this man is mortal, conceives the *whole*, "all men," in anything like a complete circumscribed manner. His conception answers neither to the objective whole (all the men who exist and have existed), which infinitely exceeds his power of knowing; nor to the subjective whole (all the men he has seen or heard of), which it is impossible for him to remember. Yet, unless logical wholes are conceived in a specific manner, Sir William Hamilton's doctrine cannot stand: for the perfect Induction and perfect Deduction, which alone he allows to be the subject-matter of Logic, imply wholes that are known by "enumeration (actual or presumed) of *all* the parts." Again; let us consider the results following from this distinction which Sir William Hamilton draws between the logical and the extra-logical. Other logicians, he says, have divided Induction "into *perfect* and

imperfect, according as the *whole* concluded, was inferred from *all* or from *some* only of its constituent parts." This he considers to involve "a twofold absurdity;" and asserts that that only is logical induction, which infers the *whole* from the enumerated *all*. Now, if this be so, there arises the question—What is the nature of that so-called *imperfect* induction which infers wholes from *some* only of the constituent parts? Sir William Hamilton says it is extra-logical. Still it is a species of reasoning—a species by which the immense majority of our conclusions are drawn; and *rightly* drawn. Hence, then, there are two kinds of Induction (as well as of Deduction), one of which is recognized by the science of reasoning, while the other is ignored by it. This implication is of itself sufficiently startling; but it will become still more so on considering the essential nature of the difference, which, according to this hypothesis, exists between the logical and the extra-logical. If, proceeding by the so-called imperfect induction, I infer from the multiplied instances in which I have seen butterflies developed from caterpillars, that all butterflies are developed from caterpillars; it is clear that the inference contains innumerable facts of which I have never been directly cognizant: from a few known phenomena, I conclude an infinity of unknown phenomena. If, on the other hand, proceeding by the so-called perfect induction, which does not allow me to predicate of the whole anything that I have not previously observed in every one of the parts, and which, therefore, does not permit, as logical, the conclusion that all butterflies are developed from caterpillars—if, proceeding by this so-called perfect induction, I say that as each of the butterflies (which I have observed) was thus developed, the whole of the butterflies (which I have observed) were thus developed; it is clear that the so-called conclusion contains nothing but what is previously asserted in the premiss—is simply a *colligation* under the word *whole*, of the separate facts indicated by the word *each*—predicates nothing before unknown. Here, then, are two kinds of mental procedure: in one of which, from some-

thing known, something unknown is predicated; in the other of which, from something known, nothing unknown is predicated. Yet both these are called reasoning—the last logical; the first extra-logical. This seems to me an impossible classification. The two things stand in irreconcilable contrast. Agreeing as I do with Sir William Hamilton in considering it as absurd to include in logic both perfect and imperfect induction; I do so on exactly opposite grounds: for this which he calls perfect induction, I conceive to be not reasoning at all, but simply a roundabout mode of defining words. All reasoning whatever, Inductive or Deductive, is a reaching of the unknown through the known; and where nothing unknown is reached, there is no reasoning. The whole process of stating premisses and drawing conclusion, is a wanton superfluity if the fact which the conclusion asserts is already given in experience. Suppose I have noticed that A, B, C, D, E, F, &c. severally possess a given attribute: do I then by this so-called Induction group them together as all possessing that attribute, that I may be subsequently enabled by the so-called Deduction to infer that E or F possesses it? Certainly not. By the hypothesis I have already noticed that E and F possess it; and knowing this by a past perception, have no need to reach it by inference. Yet this ascent from the known constituent parts to the constituted whole, is all that Sir William Hamilton recognizes as logical Induction; whilst the descent from such constituted whole to any, some, or one of such constituent parts, is all that he recognizes as logical Deduction. And thus, in the endeavour to establish necessary logical forms, he exhibits forms which the intellect never does, nor ever can with any propriety, employ.

Returning from this digression, which certain anticipated objections rendered needful, it is to be observed of the inductive process as above formulated, that it applies alike to the establishment of the simplest relations between single properties, and the most complex relations between groups of properties and groups of objects. As is now usually admitted,

the process by which a child reaches the generalization that all surfaces returning brilliant reflections are smooth to the touch, is fundamentally like that by which the physiologist reaches the generalization that, other things equal, the temperature of any species of creature is proportionate to the activity of its respiration. Between those earliest and unconsciously formed inductions on which are based the scarcely more conscious deductions that guide our movements from moment to moment, and those latest ones which only the highly cultured natural philosopher is competent to draw, may be placed a transitional series, the members of which differ, partly in the comparative infrequency with which the relations are presented to our observation; partly in the increasing complexity of the terms between which the relations subsist; and partly in the increasing complexity of the relations themselves. Throughout the whole series, however, the essential act of thought is a cognition of the likeness between certain observed relations and certain unobserved relations: the trustworthiness of which cognition varies sometimes according to the numerical ratio between the observed and unobserved relations; sometimes according to the simplicity of their nature; sometimes according to their analogy to established relations; sometimes according to all these.

Any detailed consideration of the conditions under which the inductive inference is valid, would here be out of place. We have now only to examine the nature of the mental act by which such inference is reached; and which is the same whether the data are adequate or not. The rest falls within the province of inductive logic. The only further remark at present called for, is, that (excluding the mathematical inductions before named) when the observed relations are very few in number, or when the terms between which they subsist differ considerably from the terms of the relations classed with them, or both, we have what is known as an hypothesis. Thus, to quote an example from a recent controversy, if we argue that

(This world)	a	is like	A	(Other worlds—some, many, or all—)
(Coexists with)	:		:	(Coexist with)
(Inhabitants,)	*b*		*B*	(Inhabitants,)

it is clear that, though inductive reasoning is simulated in form, the presumption that the relations are like is not strong, and nothing but probability can be claimed for the inference. If now, the likeness between the terms of the known and unknown relations were more complete—were all other worlds physically like this world in nearly every particular; the hypothesis would have increased probability: and then, if, of worlds thus physically similar, we ascertained that hundreds, thousands, tens of thousands were inhabited; the inference that all were inhabited, would become an ordinary induction—would approach in validity to the induction which, from the mortality of all known men, concludes that all men are mortal. From which mode of presenting the facts it will become manifest not only that, as we all know, hypothesis must precede induction; but further, that every hypothesis *is* an induction in the incipient stage: capable of being developed into one if there are facts for it to assimilate; fated to dwindle away if there are none.

§ 37. To the foregoing two orders of imperfect qualitative reasoning—that which proceeds from generals to particulars, and that which proceeds from particulars to generals—has to be added a third order; which Mr. Mill has named, reasoning from particulars to particulars. This, regarded under each and all of its aspects, is the primitive species of reasoning. It is that to which both Induction and Deduction may be degraded by continually diminishing the number of their observed or predicated facts; and which lies midway between them as the common root whence they diverge. It is that habitually displayed by children and by the higher animals.

And it is that in which we find the comparison of relations reduced to its simplest shape. In all the examples of imperfect qualitative reasoning hitherto given, either the known relations serving for data were plural; or the unknown relations predicated were plural; or both were plural. But in this aboriginal reasoning, both the premised and the inferred relations are singular. The mental act is an intuition of the likeness (or unlikeness) of one relation to one other relation. The burnt child who, having once experienced the connexion between the visual impression of fire and the painful sensation which fire produces upon the skin, shrinks on again having his hand put near the fire, is mentally possessed by a represented relation between fire and burning, similar to the before presented relation. He thinks of the future relation as a repetition of the past one. He sees, or, more strictly speaking, presumes, that the two relations are alike. In this rudimentary—this most simple and imperfect ratiocination, we may clearly perceive that the thing remembered, which stands for premiss, is a relation; that the thing conceived, which stands for inference, is a relation; that the presentation of one term of this inferred relation (the fire) is followed by the representation of its other term (burning); that the relation thus conceived, is so conceived, solely because there is a past experience of the relation between fire and burning; and that hence, by the very conditions of its origin, the new relation is conceived as *like* the foreknown one. And it is clear that whilst, by the multiplication of experiences, the known and unknown relations, instead of being respectively one and one, become many and many, and so originate Deduction and Induction, the act of thought by which the inference is reached, must remain throughout fundamentally similar.

CHAPTER VII.

REASONING IN GENERAL.

§ 38. Before summing up the evidence, and presenting under its most general form the doctrine which the foregoing chapters develop in detail, it will be well briefly to glance at the current theory of reasoning, with the view of showing its insufficiency.

That so many logicians should have contended that the syllogism exhibits the process of thought by which we habitually reason, would be unaccountable, were it not for the immense influence of authority on men's opinions. Passing over the general objection, that it involves a *petitio principii*, and cannot therefore represent the mode by which we find our way to new truths, a cursory examination even, will suffice to show that the syllogism is a psychological impossibility. Take a case. When I say,—

> All crystals have planes of cleavage;
> This is a crystal;
> therefore,
> This has a plane of cleavage;

and when it is asserted that this describes the mental process by which I reached the conclusion; there arises the very obvious question—What induced me to think of "All crystals"? Did the concept "All crystals," come into my mind by a happy accident, the moment before I was about to draw an inference respecting a particular crystal? No one will assert such an absurdity. It must have been, then, that a consciousness of the particular crystal identified by me as such, was antecedent to my conception of "All crystals." This, however, it will be said, is merely a formal objection; which may be met by putting

the minor premiss first. True: but this objection is introductory to a fatal one. For the mind being, as we see, necessarily occupied about the individual crystal, before it is occupied about the class; there result the two inquiries—(1), Why, having been conscious of the individual crystal, should I, in this particular case, go on to think of the class crystals; instead of thinking of some other thing? and (2), Why, when I think of the class crystals, should I think of them as having planes of cleavage; instead of thinking of them as angular, or polished, or brittle, or having axes, or in connection with any other attribute? Is it again by a happy accident that, after the individual, the class occurs to my mind? and further, is it by a happy accident that the class is remembered as having the particular attribute I am about to predicate? No one will have the folly to say—yes. How happens it, then, that after the thought—"This is a crystal," there arises the thought—"All crystals have planes of cleavage;" instead of some other of the thousand thoughts which mental suggestion might next produce? There is one answer, and only one. *Before consciously asserting that all crystals have planes of cleavage, it has already occurred to me that this crystal has a plane of cleavage.* Doubtless it is the registered experience I have had respecting the cleavage of crystals, which *determines* me to think of this crystal as having a plane of cleavage; but that registered experience is not present to my mind *before* the special predication is made; though I may become conscious of it subsequently. The process of thought which the syllogism seeks to describe, *is not that by which the inference is reached, but that by which it is justified;* and in its totality is not gone through at all, unless the need for justification is suggested. Each may at once convince himself of this by watching how any of his most familiar inferences originate. It is stated that Mr. So-and-so, who is ninety years old, is about to build a new mansion; and you directly say, how absurd it is that a man so near death should make such preparation for life. But how came you to think of Mr. So-and-so as dying? Did you first

repeat to yourself the proposition—"All men must die?" Nothing of the kind. Certain antecedents led you to think of death as one of his attributes, without previously thinking of it as an attribute of mankind at large. To any one who considered Mr. So-and-so's folly not demonstrated, you would probably reply,—"He must die, and that very shortly:" not even then appealing to the general fact. Only on being asked *why* he must die, would you, either in thought or word, resort to the argument—"All men die: therefore Mr. So-and-so must die." Obviously then, the syllogism in no way represents the ordinary inferential act; which is a single and almost unconscious intuition; but only approximately represents the process by which our inferences are, if need be, consciously verified.

As will of course be perceived, many of the formulas given in preceding chapters, are to be taken with a parallel explanation. They represent, not the primary and direct reasoning, but the secondary, and what we may call, reflex reasoning. To express any deduction by saying of the compared relations that,

$$\left.\begin{matrix} A \\ : \\ B \end{matrix}\right\} \text{ is like } \left\{\begin{matrix} a \\ : \\ b \end{matrix}\right.$$

(The class relation,) (The individual relation,)

is to raise the insuperable difficulty above suggested—that the class, with its appropriate predicate, cannot in order of thought precede the individual and that which we predicate of it; or, in other words—that we do not think of the class of before known relations as *like* the single present relation; but we think of the single present relation as *like* the class. Just as, before writing down the proportion $\overset{\text{acres.}}{3} : \overset{\text{£.}}{162} :: \overset{\text{acres.}}{4\tfrac{1}{2}} : \overset{\text{£.}}{—}$, I must have already recognized the unknown relation sought, as equal to the known relation premised: otherwise the writing

down the premised relation would be unaccountable. Hence it is manifest, that to symbolize the deductive process in a complete manner, the inferred relation must be placed before, as well as after, the class of relations to which it is assimilated; thus—

Primary or provisional inference.			Secondary or verified inference.
a	A		a
:	:	is like	:
b	*B*		*b*

The first of these three represents that act of thought in which, on the presentation of some object (a) there is suggested to the mind some unseen attribute (*b*), as possessed by it. This act is simple and spontaneous; resulting, not from a *remembrance* of the foreknown like relations (A : *B*); but merely from the *influence* which, as past experiences, they exercise over the association of ideas. Commonly, the inference thus determined suffices us; and we pass to some other thought: but if a doubt is internally or externally suggested, then the acts of thought represented by the rest of the symbol are gone through; and we have a process of conscious reasoning.

And here, respecting this series of mental acts, there occurs a consideration of some interest and importance. It is universally admitted that in the evolution of reasoning, induction must precede deduction—that we cannot descend from the general to the particular, until we have first ascended from the particular to the general. The fact now to be remarked is, that this is true not only of reasoning considered in its ensemble, but also, in a qualified sense, of each particular ratiocination. It was pointed out a few pages back, that as, in the development alike of the general mind and the individual mind, qualitative reasoning precedes quantitative reasoning;

so, each particular act of quantitative reasoning grows out of a preceding act of qualitative reasoning: and in the present case there seems to hold the analogous law, that as, in mental progress, both general and particular, induction precedes deduction; so, every particular act of deduction properly so called, presupposes a preparatory act of induction. For may we not with propriety say, that the mental transition from the spontaneously inferred relation with which every deductive process must commence, to the class of relations it belongs to; parallels the act by which the mind originally passed from particular relations to the general relation? It is true that the particular relation is in this case not an observed one; and in so far the parallel does not hold: but still, it is conceived as existing; and it is only in virtue of being so conceived that the class it is referred to is thought of. The sequence of thought, as it were, follows the channel through which the induction was before reached. In so far as each separate deductive act involves an ascent from the particular to the general, before the descent from the general to the particular; the historic relation between induction and deduction is repeated. In all cases of deduction there is either an induction made on the spur of the moment (which is often the case), or there is a rapid rethinking of the induction before made.

Resuming our more immediate topic—It is to be remarked that the amended, or rather completed, form under which the deductive process is above represented, remains in perfect accordance with the doctrine, developed in foregoing chapters; that reasoning is carried on by comparison of relations. For whether the singular relation is thought of before the plural one; or the plural before the singular; or first one and then the other; it remains throughout manifest, that they are thought of as like (or unlike) relations; and that the possibility of the inference depends on their being so thought of. On the other hand, the syllogistic theory is altogether irreconcilable with the mental processes we have just traced out—irreconcilable

as presenting the class, while yet there is nothing to account for its presentation; irreconcilable as predicating of that class a special attribute, while yet there is nothing to account for its being thought of in connexion with that attribute; irreconcilable as embodying in the minor premiss an assertory judgment (this is a man), while the previous reference to the class, men, implies that that judgment had been tacitly formed beforehand; irreconcilable as separating the minor premiss and the conclusion, which ever present themselves to the mind in relation. Whatever merit the syllogism may have as verbally exhibiting the data and conclusion in a succinct form; it wholly misrepresents the mental process by which the conclusion is really reached.

And if the syllogism, considered in the concrete, does not truly display the ratiocinative act; still less do the axiomatic principles reached by analysis of the syllogism, supply anything like a theory of the ratiocinative act. It may be said that it does not fall within the province of Logic to formulate the workings of the intellect—that it is concerned with the objective aspect of reasoning, and not with its subjective aspect, which pertains to Psychology—that all which Logic can do is to reduce overt inductions and deductions to their simplest elements, and to systematic arrangement. And this is true. But there seems to be an undefined yet general impression, that a certain abstract truth said to be involved in every syllogism, is that which the mind recognizes in going through every syllogism; and that the recognition of this abstract truth under any particular embodiment, is the real ratiocinative act. Nevertheless, neither the *dictum de omni et nullo*—"that whatever can be affirmed (or denied) of a class, may be affirmed (or denied) of everything included in the class;" nor the axiom which Mr. Mill evolves—"that whatever possesses any mark possesses that which it is a mark of;" nor indeed any axiom which it is possible to frame; can express the ratiocinative act. Saying nothing of the special objections to be urged

against these or kindred propositions, they are all, in so far as they profess to embody laws of logical thinking, open to the fundamental objection that they are substantive truths perceived by reason; not the mode of rational perception. Each of them describes a piece of knowledge; not a process of knowing. Each of them generalizes a large class of cognitions; but does not by so doing approach any nearer to the nature of the cognitive act. Contemplate all the axioms—"Things that are equal to the same thing are equal to each other;" "Things that coexist with the same thing coexist with each other;" and so forth. Each of these is a rational cognition; and if any supposed logical axiom be added to the number, it, also, must be a rational cognition. But these axioms are manifestly of one family; become known by similar intellectual acts; and no addition of a new one to the list can answer the question—What is the common nature of these intellectual acts? what is the process of thought by which axioms become known? Axioms can belong only to the subject-matter about which we reason; and not to reason itself. They imply cases in which an objective uniformity determines a subjective uniformity; and all these subjective uniformities can no more be reduced to one, than the objective ones can. The utmost that any analysis of reason can effect, is to disclose the *form of intuition* through which these and all other mediately known truths are discerned: and this we have in the inward perception of likeness or unlikeness of relations. This it is which constitutes, as it were, the common type of rational cognitions, axiomatic or other: and it is manifestly incapable of axiomatic expression; not only because it varies with every variation in the subject-matter of thought; but because the universal *process* of rational intelligence, cannot become solidified into any single *product* of rational intelligence.

§ 39. And now, that the truth of the several doctrines enunciated in foregoing chapters may be still more clearly seen, let us glance at the series of special results that have been reached;

and observe how harmoniously they unite as parts of one consistent whole.

We noticed that perfect quantitative reasoning, by which alone complete previsions are reached, involves intuitions of coextension, coexistence, and connature in the things reasoned about; besides connature in the compared relations, and cointension in the degree of those relations—equality among the entities in Space, Time, Quality; and among their relations in kind and measure: that thus in the highest reasoning, not only does the idea of likeness rise to its greatest perfection (equality), but it appears under the greatest variety of applications; and that in imperfect quantitative reasoning where non-coextension is predicated, either indefinitely (these magnitudes are unequal) or definitely (this magnitude is greater than that), the idea of exact likeness is no longer so variously involved. We next noticed that in perfect qualitative reasoning, the intuition of coextension ceases to appear; but that there is still coexistence and connature amongst the terms, along with connature and cointension amongst the relations subsisting between those terms: that thus there is a further diminution in the number of implied intuitions of equality; and that in parti-perfect qualitative reasoning, where non-coexistence is predicated either indefinitely (these things do not exist at the same time) or definitely (this follows that), the number of such implied intuitions is still further reduced: though there yet remains equality in the natures of the things dealt with, and in the natures of the compared relations. We have now to notice, what was not noticed in passing, that in imperfect qualitative reasoning we descend still lower; for in it, we have no longer complete equality of nature in the terms of the compared relations. Unlike lines, angles, forces, areas, times, &c., the things with which ordinary class reasoning deals, are not altogether homogeneous. The objects grouped together in an induction are never exactly alike in every one of their attributes; nor is the individual thing respecting which a deduction is made, ever quite indistinguishable in character from the things with which

it is classed. No two men, or trees, or stones, have the same absolute homogeneity of nature that two circles have. Similarly with the relations between these terms: though they remain connatural, do not remain cointense. And thus, in our contingent every-day reasoning, we have only likeness of nature in the entities and attributes involved; equality of nature in the relations between them; and more or less of likeness in the degree of those relations. The subjects must be like; the things predicated of them must be like; and the relations must be homogeneous, if nothing more. Even when we come to the most imperfect reasoning of all—reasoning by analogy—it is still to be observed that, though the subjects and predicates have severally become so different that not even likeness of nature can be safely asserted of them; there still remains likeness of nature between the compared relations. If the premised relation is a sequence, the inferred one must be a sequence; or they must be both coexistences. If one is a space-relation and the other a time-relation, reasoning becomes impossible. As a weight cannot be compared with a sound; so, neither can there be any comparison between relations of different orders. And hence, whatever else may disappear, the compared relations must continue to be of like nature. Without this there can be no predication of any other likeness or unlikeness; and therefore no reasoning. This fact, that, as we descend from the highest to the lowest kinds of reasoning, the intuitions of likeness among the elements involved, become both less perfect and less numerous, but never wholly disappear, will hereafter be seen to have great significance.

Passing from the elements of the rational intuitions to their forms, we find that these are divisible into two genera: in the one of which the compared relations, having a common term, are conjoined; and in the other of which the compared relations, having no common term, are disjoined. Let us glance at the several species comprehended under the first of these

genera. Having necessarily but three terms, these have for their types the forms

A : B is equal to B : C;
its indefinite negation,
A : B is unequal to B : C;
and its definite negation,
A : B is $\left\{\begin{matrix}\text{greater}\\ \text{or less}\end{matrix}\right\}$ than B : C.

If, in the first of these forms, A, B, and C represent magnitudes of any order; then, if they are severally equal, we have the axiom—"Things that are equal to the same thing are equal to each other;" and if they are severally unequal, we have a case of mean proportionals. In the second form, if A, B, and C are magnitudes, we have the converse of the above axiom; whilst the thing determined is the inequality of A and C. And in the third form, the thing determined is the superiority or inferiority of A to C. Again, if A, B, and C instead of being magnitudes are times, either at which certain things continuously exist or at which certain events occur, then the first form represents the axioms—"Things that coexist with the same thing coexist with each other," and "Events which are simultaneous with the same event are simultaneous with each other." The second form stands for the converse axioms; and predicates the non-coexistence or non-simultaneity of A and C. While the third symbolizes cases in which A is concluded to be before or after C. To make these facts clear, let us formulate each variety.

SPACE-RELATIONS.

A is equal to B; B is equal to C; therefore A is equal to C.
A is equal to B; B is unequal to C; therefore A is unequal to C.
A is equal to B; B is $\left\{\begin{matrix}\text{greater}\\ \text{or less}\end{matrix}\right\}$ than C; therefore A is $\left\{\begin{matrix}\text{greater}\\ \text{or less}\end{matrix}\right\}$ than C.
A is $\left\{\begin{matrix}\text{greater}\\ \text{or less}\end{matrix}\right\}$ than B; B is $\left\{\begin{matrix}\text{greater}\\ \text{or less}\end{matrix}\right\}$ than C; therefore A is $\left\{\begin{matrix}\text{greater}\\ \text{or less}\end{matrix}\right\}$ than C.

TIME-RELATIONS.

A $\left\{\begin{matrix}\text{is simultane-}\\\text{ous with}\end{matrix}\right\}$ B; B $\left\{\begin{matrix}\text{is simultane-}\\\text{ous with}\end{matrix}\right\}$ C; therefore A $\left\{\begin{matrix}\text{is simultane-}\\\text{ous with}\end{matrix}\right\}$ C.

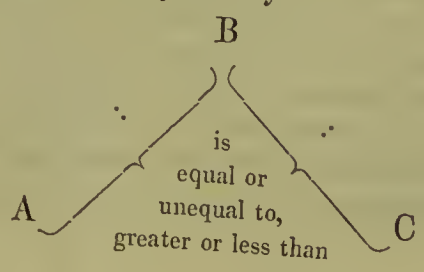
A $\left\{\begin{matrix}\text{is simultane-}\\\text{ous with}\end{matrix}\right\}$ B; B $\left\{\begin{matrix}\text{is not simul-}\\\text{taneous with}\end{matrix}\right\}$ C; therefore A $\left\{\begin{matrix}\text{is not simul-}\\\text{taneous with}\end{matrix}\right\}$ C.

(and similarly if there is coexistence instead of simultaneity)

A $\left\{\begin{matrix}\text{is simultane-}\\\text{ous with}\end{matrix}\right\}$ B; B is $\left\{\begin{matrix}\text{before or}\\\text{after}\end{matrix}\right\}$ C; therefore A is $\left\{\begin{matrix}\text{before or}\\\text{after}\end{matrix}\right\}$ C.

A is $\left\{\begin{matrix}\text{before or}\\\text{after}\end{matrix}\right\}$ B; B is $\left\{\begin{matrix}\text{before or}\\\text{after}\end{matrix}\right\}$ C; therefore A is $\left\{\begin{matrix}\text{before or}\\\text{after}\end{matrix}\right\}$ C.

It must not be supposed, however, that Time and Space relations are the only ones that can enter into these forms. Relations of Force under its various manifestations, may be similarly dealt with. To use Sir William Hamilton's nomenclature, there is Extensive quantity (in Space); Protensive quantity (in Time); and Intensive quantity (in the degree of the Actions that occur in space and time). It is true, as before shown, (§ 25) that intensive quantities, as those of weight, temperature, &c. cannot be accurately reasoned about without reducing them to equivalent quantities of extension; as by the scales and the thermometer: but it is none the less true that there is a simple order of inferences respecting intensive quantities, exactly parallel to those above given. If, for example, a ribbon matched in colour some fabric left at home; and matches some other fabric at the draper's; it is rightly inferred that these fabrics will match each other: or if, on different occasions, a piece of music had its key note pitched by the same tuning fork; it is to be concluded that the pitch was alike on both occasions. And similarly in various other cases, which it is needless to specify. In all of them, as well as in the various ones above given, the intuition, both in its positive and negative forms, is represented by the symbol



The only further fact of importance to be remarked of them, is, that not only are the two relations homogeneous in nature, but all the three terms are so likewise. Whence, in part, arises the extremely-limited range of conjunctive reasonings.*

The other genus of rational intuitions, distinguished by having four terms, and therefore two separate or disjoined relations, is represented by the typical forms—

A : B is equal to C : D;
its indefinite negation,
A : B is unequal to C : D;
and its definite negation,

$$A : B \text{ is } \left\{\begin{matrix}\text{greater}\\ \text{or less}\end{matrix}\right\} \text{ than } C : D.$$

To which must be added the two modified forms which result when the reasoning is imperfect—

A : B is like C : D;
and its negation,
A : B is unlike C : D.

* I ought here to mention that some year and a half since, in the course of a conversation in which the axiom—"Things that coexist with the same thing coexist with each other," was referred to; it was remarked by a distinguished lady—the translator of Strauss and Feuerbach—that perhaps a better axiom would be—"Things that have a constant relation to the same thing have a constant relation to each other." Not having at that time reached the conclusion that a formula having but three terms could not express our ordinary ratiocinations, which involve four; I was greatly inclined to think this the most general truth to which the propositions known by reason are reducible: the more so as, being expressed in terms of relations, it assimilated with many results at which I had already arrived in the course of analyzing the lower intellectual processes. As will appear, however, from the preceding chapters, subsequent inquiry led me to other conclusions. Nevertheless, this suggestion was of much service in directing my thoughts into a track which they might not else have followed. Respecting this axiom itself, it may be remarked that as the word *constant*, implies *time* and *uniformity*, the application of the axiom is limited to necessary time-relations of the conjunctive class. But if, changing the word constant for a more general one, we say—Things which have a definite relation to the same thing have a definite relation to each other; we get an axiom which expresses the most general truth known by conjunctive reasoning—positive and negative, quantitative and qualitative.

If, in the first of these five, the letters represent homogeneous magnitudes; then, when A equals B, and C equals D, we have represented the group of axioms—If equals are added to, subtracted from, multiplied by, &c., equals, the results are equal; as well as all the ordinary algebraic reasonings into which these axioms enter: and when each of the two ratios is not one of equality, we have an ordinary proportion. Supposing that the four terms are not homogeneous throughout, but only in pairs; then the formula stands for common geometrical reasoning: and when the things represented are not magnitudes, but simply entities and attributes that are alternately homogeneous; we have that order of reasoning by which necessary coexistences and sequences are recognized. Again, in the second and third forms—if all the terms are homogeneous magnitudes, then inequations and certain axioms antithetical to the above are symbolized: if the magnitudes are but alternately homogeneous, there is typified that imperfect geometrical reasoning by which certain things are proved always greater or less than certain others: and when the letters stand not for magnitudes but simply for entities, properties, or changes, we have that species of necessary qualitative reasoning which gives negative predications. Lastly, by the fourth and fifth forms are signified all orders of common class-reasoning: from that which is next to necessary to that which is in the highest degree problematical: inclusive alike of Induction, Deduction, Analogy, and Hypothesis. All these sub-genera and species of Disjunctive Reasoning are representable by the one symbol—

$$\left.\begin{matrix} A \\ \\ : \\ \\ B \end{matrix}\right\} \begin{matrix} \text{is equal or} \\ \text{unequal to,} \\ \\ \text{greater or} \\ \text{less than,} \\ \\ \text{like or} \\ \text{unlike,} \end{matrix} \left\{\begin{matrix} C \\ \\ : \\ \\ D \end{matrix}\right.$$

And the several varieties may be classified in three distinct modes; according as the basis of classification is—(1) the

degree of resemblance between the two relations; (2) the *nature* of the compared relations; and (3) the comparative *number* of the premised and inferred relations. Under the first of these classifications, we have the divisions—Positive and Negative; Perfect, Parti-perfect, and Imperfect; Necessary and Contingent; Analogical. Under the second, we have the two great divisions—Quantitative and Qualitative: of which the one may be Proportional, Algebraic, or Geometrical, according as the terms of each relation are or are not homogeneous, and are or are not equal; and of which the other may refer to either co-existences or sequences, whether between attributes, things, or events. Under the third, we have reasoning divided into Inductive, Deductive, Hypothetical; which are classifiable according to the numerical ratio between the premised and inferred relations. Thus, if the inference is

Premised Relations.	Inferred Relations.	
from *one*	to *one;*	the reasoning is from particulars to particulars; and is valid in necessary matter (as mathematics), but not in contingent matter.
If from *one*	to *all;*	we have a species of induction that is valid or vicious, according as the matter is necessary or contingent.
If from *few*	to *all;*	it amounts to ordinary Hypothesis.
If from *many*	to *all;*	it is Induction proper.
If from *some*	to *one;*	it is what we may call Hypothetical deduction.
If from *all*	to *one;*	it is Deduction proper.
Or from *all*	to *some;*	

The only further fact to be noted respecting the disjunctive form of reasoning, is, that it includes certain inferences which can be classed neither with the inductive, the deductive, the process from particulars to particulars, nor any of their modifications:

inferences namely, that are at once drawn, and correctly drawn, in cases that have not been before paralleled in experience. Thus, if A be but a hundredth part less than B; it is at once inferable that a half of A is greater than a third of B. Neither a general principle nor a particular experience, can be quoted as the premiss for this conclusion. It is reached directly and independently by a comparison of the two relations named; and is satisfactorily explicable neither on the hypothesis of forms of thought, nor on the experience-hypothesis as ordinarily interpreted. We may aptly term it a *latent* inference; and its genesis, like that of many others, is to be properly understood only from that point of view, whence, as already hinted, these antagonist hypotheses are seen to express opposite sides of the same truth. Of this more in the sequel. Meanwhile let it be observed that while the species of reasoning thus exemplified is obviously effected, like all others, by comparison of relations; it cannot be conformed to any of the current theories.

Respecting those most complex forms of reasoning analyzed in the first chapter, which deal not with the quantitative or qualitative relations of things, but with the quantitative relations of quantitative relations; it is needless now to do more than remind the reader that they arise by duplication of the forms above given; and that in their highest complications they follow the same law. Perceiving as he thus will that the doctrine enunciated applies alike to all orders of reasoning, from the most simple to the most complex—from the necessary to the remotely contingent; from the axiomatic to the analogical; from the most premature induction to the most rigorous deduction—he will see that it fulfils the character of a true generalization: that, namely, of explaining all the phenomena.

§ 40. One other group of confirmatory evidences may with advantage be noticed: those which are supplied by our ordinary forms of speech. Already one or two of them have been incidentally pointed out. They are so numerous and so sig-

nificant, that even standing alone they would go far to establish the theory that has been developed. Thus we have the Latin *ratio,* meaning reason; and *ratiocinor,* to reason. This word *ratio* we apply to each of the two quantitative relations forming a proportion; and the word *ratiocination,* which is defined as "the act of deducing consequences from premisses," is applicable alike to numerical and to other inferences. Conversely, the French use *raison* in the same sense that *ratio* is used by us. Throughout, therefore, the implication is that *reason*-ing and *ratio*-ing are fundamentally identical. Further be it remarked that *ratiocination,* or reasoning, is defined as "the *comparison* of propositions or facts, and the deduction of inferences from the comparison." Now every proposition or asserted fact, involving as it does a subject and a something predicated of it, necessarily expresses a relation: hence the definition may be properly transformed into, "the comparison of relations" &c.: and as the only thing effected by comparison is a recognition of the likeness or unlikeness of the compared things; it follows that inferences said to be deduced from the comparison, must result from the recognition of the likeness or unlikeness of relations. Again, we have the word *analogy* applied alike to proportional reasoning in mathematics, and to the presumptive reasoning of daily life. The meaning of analogy is, "an *agreement* or *likeness* between things in some circumstances or effects, when the things are otherwise entirely different:" and in mathematics, an analogy is "an agreement or likeness between" two ratios in respect of the quantitative contrast between each antecedent and its consequent; though their constituent magnitudes are unlike in amount, or in nature, or in both. So that in either case, to "deny the analogy," is to deny the assumed likeness of relations. Then we have the common expressions—"by *parity* of reasoning," and "the cases are not upon a *par.*" Parity means *equality;* and being upon a par means being upon a *level;* so that here, too, the essential idea is that of likeness or unlikeness. Note also, the familiar qualifications,—"*cæteris paribus,*" "other

things equal;" which are used with the implication that when all the remaining elements of the compared cases stand in like relations, the particular elements in question will stand in like relations. Further, there is the notion of parallelism. It is an habitual practice in argument to draw a *parallel*, with the view of assuming in the one case what is shown in the other. But parallel lines are those that are always *equi*-distant —that are *like* in direction: and thus the fundamental idea is still the same. Once more: not only do men reason by similes of all orders, from the parable down to the mere illustration; but *similarity* is constantly the alleged ground of inference, alike in necessary and in contingent reasoning. When geometrical figures are known to be similar, and the ratio of any two homologous sides is given; the values of all the remaining sides in the one, may be inferred from their known values in the other: and when the lawyer has established his precedent he goes on to argue, that *similarly*, &c. Now as, in geometry, the definition of similarity is, equality of ratios amongst the answering parts of the compared figures; it is clear that the similarity on the strength of which ordinary inferences are drawn, means—likeness of relations. Various other phrases, such as, "The *comparison* is not fair;" "What is true in this case will be true in that;" "*Like* causes will produce *like* results;" may be mentioned as having the same implication. Nay more: not only is the process of thought by which both our simplest and our most complex inferences are drawn, fundamentally one with that by which proportional inferences are drawn; but its verbal expression often simulates the same form. Just as in mathematics we say—*As* A is to B, *so* is C to D; so in non-quantitative reasoning we say—*As* a muscle is to be strengthened by exercise, *so* is the rational faculty to be strengthened by thinking. And indeed, this sentence supplies a double illustration; for not only does each of the two inferences it compares exhibit the proportional form; but the comparison itself exhibits that form. Thus it is

throughout manifest, that our habitual modes of expression bear witness to the truth of the foregoing analysis.

§ 41. And now, as an appropriate finish to this somewhat too lengthened exposition, I would briefly point out that the conclusion reached may be established even *à priori*. When towards the close of this Special Analysis we come to consider the ultimate elements of consciousness; it will be abundantly manifest that the phenomena of reasoning cannot, in the nature of things, be truly generalized in any other way. But without waiting for this simplest and most conclusive proof eventually to be arrived at; it may, even from our present stand-point, be demonstrated by two separate methods, that every inference of necessity involves an intuition of the likeness or unlikeness of relations. Already, incidental reference has been made to these *à priori* arguments; but they claim a more definite statement than they have hitherto received.

Both of them are based immediately upon the very definition of reason, considered under its universal aspect. What is the content of every rational proposition? Invariably a predication—an assertion that something is, was, or will be, conditioned (or not) in a specified manner—that certain objects, forces, attributes, stand to each other thus or thus, in Time or Space. In other words—the content of every rational proposition is, *some relation*. But what is the condition under which alone a relation is thinkable? It is thinkable only as of a certain *order*—as belonging, or not belonging, to some *class* of before-known relations. It must be with relations as with the terms between which they subsist; which can be thought of as such, or such, only by being thought of as members of this or that class. To say—"This is an animal;" or "This is a stone;" or "This is the colour red;" of necessity implies that animals, stones, and colours have been previously presented to consciousness. And the assertion that this is an animal, a stone, or a colour, is, in such case, a grouping of

the new object of perception, with the similar objects before perceived. In like manner the inferences—"That berry is poisonous;" "This solution will crystallize;" are impossible even as conceptions, unless a knowledge of the relations between poison and death, between solution and crystallization, have been previously put into the mind; either immediately by experience, or mediately by description. And if a knowledge of such relations pre-exists in the mind, then the predications—"That berry is poisonous;" "This solution will crystallize;" imply that certain new relations are thought of as belonging to certain classes of relations—as being severally of the same order as one or more relations previously known. It follows, then, that contemplated from this point of view, *reasoning is a classification of relations*. But what does classification mean? It means the grouping together those that are *like*—the separation of the *like* from the *unlike*. Hence, therefore, in inferring any relation we are necessitated to think of it as one (or not one) of some class of relations; and thus to think of it, is to think of it as like or unlike certain other relations. Inference is impossible on any other condition.

Again, passing to the second *à priori* argument, let us consider what is the more specific definition of reasoning. Not only does the proposition embodied in every inference, assert a relation; but every proposition, whether expressing mediate or immediate knowledge, asserts a relation. In what, then, does the knowing a relation by reason, essentially differ from the knowing it by perception? It differs by its *indirectness*. Every cognitive act, consisting as it does in the consciousness of a definite relation between two things, (in contradistinction to that *in*definite relation which is already known to obtain between them as severally existing in Space and Time), the process of cognition is distinguishable into two separate kinds; according as the relation is disclosed to the mind *directly* or *indirectly*. If the two things are so presented that the relation between them is immediately cognized—if their

coexistence, or succession, or juxtaposition, is knowable through the senses; we have a perception: but if their coexistence, or sequence, or juxtaposition, is not knowable through the senses—if the relation between them is mediately cognized; we have a ratiocinative act. Reasoning, then, is definable as *the indirect establishment of a definite relation between two things.* But now the question arises—By what process can the indirect establishment of a definite relation be effected? There is but one answer. If a relation between two things is not directly knowable; it can be disclosed to the mind only through the intermediation of relations that are directly knowable, or are already known. Two mountains not admitting of a side by side comparison, can have their relative heights determined only by reference to some common datum line; as the level of the sea. The relation between a certain distant sound and the blowing of a horn, can be established in consciousness, only by means of a before-perceived relation between such a sound and such an action. Observe, however, that in neither case can any progress be made so long as the relations are separately contemplated. Knowledge of the altitude of each mountain above the sea, will give no knowledge of their relative altitudes, until their two relations to the sea are thought of together, as having a certain relation. The remembrance that a special kind of sound is simultaneous with the blowing of a horn, will be of no service unless this general relation is thought of in connection with the particular relation to be inferred. Hence, then, every ratiocinative act is *the establishment of a definite relation between two definite relations.*

These two general truths—That reasoning, whether exhibited in a simple inference, or in a long chain of such inferences, is the indirect establishment of a definite relation between two things; and that the achievement of this, is by one or many steps, each of which consists in the establishment of a definite relation between two definite relations; embody,

under the most abstract form, the various results arrived at in previous chapters.*

* A brief statement of the theory of Reasoning here elaborated in detail, will be found in an essay on "The Genesis of Science," published in the *British Quarterly Review*, for July, 1854. In that essay I have sought to show, that scientific progress conforms to the laws of thought disclosed by the foregoing analysis. It contains accumulated illustrations of the fact, that the discoveries of exact science, from the earliest to the latest, severally consist in the establishment of the equality of certain relations whose equality had not been before perceived. That the progress of human reason, as viewed in its concrete results, should throughout exemplify this generalization, as it does in the clearest manner, affords further confirmation of the foregoing analysis: if further confirmation be needed.

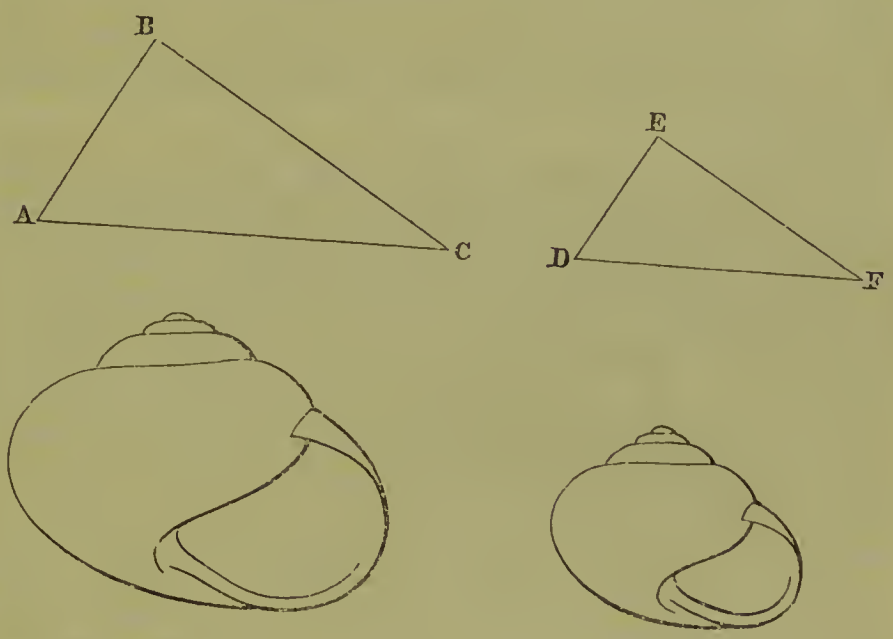
CHAPTER VIII.

CLASSIFICATION, NAMING, AND RECOGNITION.

§ 42. It needs but to read a page of any treatise on Logic, to see that there is a close alliance between Reasoning and Classification. The alliance is much closer than is supposed. It is not simply that, as every logician holds, Reasoning presupposes Classification; but also that Classification presupposes Reasoning. This statement seems to involve a contradiction; and would do so, were Reasoning and Classification wholly distinct things. But the solution of the apparent paradox, lies in the fact, that they are different aspects of the same mental process—are the necessary complements of each other. Already in describing reasoning as the classification of relations, its near approach to the classification of entities has been implied: and if we remember that whilst, on the one hand, classification of relations involves classification of the things or attributes between which they subsist; on the other hand classification of entities involves classification of the relations among their constituent attributes; the kinship of the two will appear still closer. But let us compare them in detail.

It is self-evident that the idea underlying all classification is that of *similarity*. When we group an object with certain others, we do so on the ground that in some or all of its characteristics it resembles them. Whether it be in classing together the extremely like individuals constituting a species; whether it be in uniting under the general division, vertebrata, such apparently heterogeneous creatures as a fish and a man, a snake and a bird; or whether it be in regarding both animate and inanimate objects as members of the great class, solid bodies; there is always *some* community of attributes—always

some similarity in virtue of which they are colligated. But, as was lately pointed out, similarity means equality or likeness of relations. When it is said that the two triangles ABC, DEF, are similar; the specific assertion involved is, that AB is to BC, as DE to EF; or, generally, that the quantitative relation between any two sides of the one, is equal to that between the homologous sides of the other. And when the two annexed



shells are classed as of the same species, it is manifest that, as before, the perception of similarity is a perception that the relations amongst the several parts of the one, are equal to, or like, those among the homologous parts of the other; not only in size, but to a great extent in colour, texture, and so on. What, then, is the difference between the acts of thought by which, from the perception of similarity in the triangles, there is evolved an inference respecting the value of some side; and by which, from the perception of similarity in the shells, there is evolved the idea of identity of class? The difference consists simply in this. Similarity has several implications: after the perception of similarity any one of these may present itself to consciousness; and according as one or other of the two leading kinds of implication is thought of, we have, either reasoning or

classification. To speak specifically—It is impossible to perceive anything to be similar to another, or others, without, to some extent, thinking of that other, or those others: at the same time it is impossible to perceive similarity between things, without being more or less conscious of that likeness of relations which constitutes their similarity. Either of these two latent implications may become the subject of distinct contemplation. If we consciously recall the things to which this particular one is similar, we classify; if, consciously dwelling upon the likeness of relations, we think of certain implied attributes, we reason.

"But how," it may be asked, "does this prove that classification presupposes reasoning; as well as reasoning, classification? It may be true that the intuition of similarity is their common root. It may be true that our conscious inferences involve acts of classing. But it does not, therefore, follow that our conscious acts of classing involve inferences." The reply is, that in all ordinary cases, the majority of the like relations in virtue of which any object is classed with certain before known ones, are recognized, not by perception, but by reason. The structural, tangible, gustable, ponderable, and other sensible attributes, ascribed to an orange, are not included in the visual impression received from the orange; but, as all admit, are inferred from that impression. Yet these various inferred attributes are included in the concept—an orange. When I reach out my hand towards this reddish-yellow something, under the belief that it is juicy, and will slake thirst; I have already, in judging it to be an orange, necessarily conceived it as having various attributes besides the observed ones: every one of which I know to exist, only by the same process that I know the juiciness to exist. The act of classing, then, involves a whole group of inferences; of which the particular inference drawn is only one. And had some other been drawn, as that the taste was sweet, what is now distinguished as the inference would have been one of the data—one of the attributes involved in the judgment—this is an orange. Should

any one contend that these various unspecified attributes are not inferred in the act of classing; but that the entire thought implied is — All reddish-yellow, spherical, polished, pitted bodies of a certain size are juicy; the untruth of the position will be at once seen on remembering what takes place, if a mock-orange made of painted stone is laid hold of. The unusual, the *unexpected* weight, and hardness, instantly lead to a change of classification: it is at once perceived that the body is not an orange. And this fact proves that something else than juiciness had been inferred; had been wrongly inferred; and had involved a wrong classification. Further evidence, were it needed, might be drawn in abundance from those higher processes of classification pursued by men of science, in which the reasoning is conscious and elaborate: the implication being that what is knowingly done in scientific classification, is unknowingly done in ordinary classification.

And herein lies another essential vice of the syllogistic theory. That theory proceeds upon the supposition that the act of referring any individual object to a class, is not an act of inference. The constant assumption is that the minor premiss, "This is a —," is immediately known; whereas it is always known mediately. The process of reasoning is already involved in the cognition of the very data out of which the reasoning process is said to be evolved. On the hypothesis that the syllogism represents the entire ratiocinative operation, it is contended that its conclusion is necessary. Meanwhile, the all-essential fact which it posits as the foundation of that conclusion, is itself known by an unexpressed ratiocination. The concluded fact, and the fact from which it is concluded, stand on the same footing. The proposition —That which I see is an orange; has no greater certainty than the proposition—That which I see is juicy. The visual impressions of form, size, colour, and surface, received from it, form the sole ground for both propositions. The wider inference —It is an orange; can give no extra-validity to the narrower inference—It is juicy; seeing that for the first there is no

more evidence than for the last. Yet the doctrine of the syllogism implies that the one is the warrant for the other—implies that I can *directly* know that this something belongs to the class, oranges, and, by so doing, can *indirectly* know that it is juicy!

No such insuperable difficulty, however, stands in the way of the theory now enunciated. A perception of similarity—an intuition of likeness of relations, underlying at once the act of classification, or general inference, and the act of ratiocination which gives any special inference, is the basis of either or both, as the case may be. Along with the visible attributes of an orange, may be represented to the mind in various degrees of distinctness, some, many, or all of the attributes before found in relation with such visible attributes; and, according to the mode in which they are represented, the thing predicated is the class, or some one or more of the attributes. If the various unperceived attributes are thought of in their totality, and no one of them becomes specially prominent to consciousness; then, the object in being mentally endowed with all the characteristics of its class, is conceived as one of that class, or is classified. But if one, or a group, of the unperceived attributes arrests the consciousness, and occupies it to the partial exclusion of the other unperceived attributes; then, we have a special inference, or what is verbally embodied as such. Of course the two processes being thus related, run into each other so readily and rapidly, that probably neither ever occurs without the other. It is scarcely possible that the aggregate of unperceived attributes should be thought of without some of them being represented to the mind more vividly than the rest; and it is scarcely possible that any one of them should so completely engross the mind as totally to banish all others. Always the special attribute inferred has for its indistinct background, those many accompanying attributes which constitute the conception of the object as one of a class; and always among the many attributes united in this classing conception, some one or more attributes stand out as incipient in-

ferences. A latent classing accompanies the inferential act: latent inferences accompany the act of classing: and each continually arousing the other, alternates with it in consciousness. Thus we see that whilst likeness of relations is the intuition common to reasoning and classification; it results in one or the other, according as the relations thought of are total or partial.

§ 43. If we regard the name of a thing as a kind of conventional attribute, it will be manifest that, on the presentation of the thing to the mind, this conventional attribute becomes known, as any unseen real attribute becomes known—by an act of inference. The immediately perceived properties are thought of as standing towards various unperceived properties in relations like those previously experienced; and amongst these unperceived properties, is that of calling forth from human beings a certain articulate sound—the name. It is true that this property is not inherent; but depends on an almost accidental relation established between the thing and a limited class of minds. But the like is true of various other properties which we commonly ascribe to the thing itself. As all admit, the so-called secondary qualities of body are not intrinsic; but are the affections produced in our organs by unknown agents; and they so vary, that the same thing may be warm or cold, loud or low, pleasant or disagreeable, according to the character or state of the individual. If, then, these subjective and partially incidental affections, are regarded as attributes of the objects affecting us, and are often ascribed to them inferentially; we may say that the yet more purely subjective and incidental affections which an object produces on us when it suggests its name, is also in a strained sense an attribute, and becomes known by a similar mental process.

But it is by no means necessary to the argument that names should be thus considered as factitious attributes, dependent for their production, like secondary ones, upon organic conditions; though conditions that are far less constant. The fact,

that the name of an observed object becomes present to consciousness after the same manner that an unperceived attribute does, may be rendered manifest without seeking any similarity between the things themselves. Observe what happens with a child. The name *orange,* which it probably first hears on a sample of that fruit being given to it, and which is often repeated in connection with similar visible and tangible attributes, is established in its mind as a phenomenon having a more or less constant relation to the various phenomena which the orange presents. Not having as yet any notions of necessary and accidental relations, the particular sound accompanying these particular appearances, is as much grouped with them as the particular taste is. When the particular appearances recur, a relation (like the previously experienced relation) between them and this allied sound, is as likely to enter into the mind, as a relation between them and the allied taste. The mental act is essentially the same; and though subsequent experiences modify it in so far as the resulting conception is concerned, they cannot alter its fundamental nature. The genesis of the thought by which a thing is named must ever remain identical in nature; and to the last, as at the first, likeness of relations must be the intuition implied in it.

Still more manifest will become the close kinship between naming and reasoning, when we call to mind that aboriginally, a name is a copy of some real attribute of the thing named. It is inferable alike from the prattling of children and from the speech of savages, that all language is in the beginning mimetic. Wherever we can trace out the origin of symbols used to convey thoughts—whether it be in the infantine habit of naming animals by imitating their cries, or in that of senselessly repeating the articulate sounds made by persons around; whether it be in the signs spontaneously hit upon by deaf-mutes, or those by which travellers in strange lands express their wants; whether it be in the dramatic gestures with which the uncivilized man eks out his imperfect vocabulary, or in the simulative words of which that vocabulary so largely con-

sists—we see, not only that the notion of likeness underlies all language, but that the symbols of thought, both vocal and mechanical (and even literal also), are at first, merely *reproductions* of the things signified. And if, as no one who has examined the facts can question, names, in their earliest unmodified forms, are either directly or metaphorically descriptive of one or more distinctive attributes; then, it is clear that primarily an act of naming is simply an inference becoming vocal. If a Bosjesman, catching sight of some wild animal, conveys the fact to his fellows by pointing towards it and mimicking the sound it is known to make; beyond doubt this sound came into his mind as an inferred attribute. And it differs from any other inferred attribute solely in this; that instead of being simply represented to his consciousness, it is further re-represented by his voice: the inference, instead of remaining ideal, becomes, in a sense, real. Not only, then, is it true, that by ourselves the name of a thing is always thought of in the same way that any inferred attribute is thought of; but we find that, originally, a name was *literally* an inferred attribute transformed—an inference which, arising in the mind of the individual by a representative act, is forthwith presentatively conveyed by him to other minds. It is scarcely needful to add that, developing as language does by insensible modifications and complications out of this primitive process of naming; it follows throughout the same general law. Almost losing, though it ultimately does, the marks of its inferential genesis; it needs but to watch the use of new metaphors and the coining of new words, to see under a disguised form, the same fundamental intuition of likeness of relations.

§ 44. From the acts of Classification and Naming, let us now pass to the act of Recognition. When the relations subsisting among any group of attributes, are not simply *like* the relations subsisting among some before-known group, but are in most, if not in all respects, *equal* to them; and when the

attributes themselves (as those of height, breadth, colours, &c.) are also *equal;* then we conclude the object presenting them to be the *same* object that we before knew. Recognition differs from classification, partly in the fact that the two compared groups of relations usually present a much higher degree of likeness; but mainly in the fact that not only are the relations alike, but the constituent attributes are alike. There are two kinds of difference which objects present: difference in one or more of their sensible properties, as considered severally and separately; and difference in the mode in which these sensible properties are co-ordinated, or related to each other. If the relations differ, the objects are known to be of different species. If the relations are alike, but the properties as individually considered different; the objects are of the same species. And if the relations are alike, and the individual properties are alike —that is, if there is no discernible difference; we know the object as one previously perceived—we identify it—we recognize it. To speak more specifically—If, passing over all those wider classes, such as minerals, plants, &c., whose members present very few relations in common; and those narrower but still very comprehensive ones, such as houses, crystals, quadrupeds, which have a more decided similarity; and again, those yet narrower ones that are called genera—if, passing over all these, we confine our attention to those narrowest and most precise classes which unite individuals of the same kind, as asses, fir-trees, balloons; we see that whilst in respect of each particular attribute, there need not be anything like equality, there must be equality, or at least extreme likeness, in respect of the mode in which the attributes are combined. Whether the ass be six feet long or four feet long—whether dark brown or light brown, does not affect the classification; providing the *proportions* of its body and limbs in their ensemble and details, are indistinguishable, or next to indistinguishable, from those of other asses. It matters not whether the fir-tree be one foot high or a hundred feet; it is still classed as a fir-tree, if the *relations* of the branches to each other and to the stem, in

position, direction, and length, together with the proportions and grouping of the pin-shaped leaves, are like those of fir-trees in general. But that a particular person or place should be identified as a person or place before seen, implies in the great majority of cases, not only that the elements which compose the perception should stand to each other in relations that are indistinguishable from the remembered relations; but further, that each of the elements individually, should be indistinguishable from the remembered element.

I say in the majority of cases, because, though this is the fundamental prerequisite to recognition, it is not always rigorously fulfilled. Were not objects liable to change, it might be affirmed without qualification. But our general experience of the changeableness of things, often leads us to predicate identity where there is not only some failure of likeness between the perceived and the remembered attributes, but when even the relations in which they stand to each other are no longer quite the same. Though, if the body be inanimate, we look for sameness in the dimensions and their several ratios, we are not prevented from knowing it again, by the absence of a corner, by some change of colour, by the loss of polish, and so on. And an animate body may be recognized as a particular individual, even though it has greatly altered in bulk, in colour, and even in proportions—even though a limb has disappeared, the face become thin, and the voice weak. But when, as in these instances, the identity is perceived, in virtue of some very distinctive attributes and relations which remain unaltered; it is manifest that the particular perceptions are interpreted by the help of sundry generalizations respecting the changes to which certain classes of bodies are liable; and that thus the act of simple recognition, properly so called, is greatly disguised. It should be remarked too, that in cases of this kind the distinction between Recognition and Classification is very liable to disappear. It frequently becomes a question whether the observed object is the identical one before seen, or another of the same class. Both which facts further confirm the definitions above given.

But perhaps the antithesis will be most clearly exhibited, by choosing a case in which recognition is impossible, in consequence of the extreme likeness of the individuals constituting the class. Suppose, while taking a needle from among sundry others of the same size, the whole paper-full is dropped on the floor. To fix upon the one which was about to be taken, is known to be hopeless. Why? Because the needles are so exactly alike in all respects, that no one of them is distinguishable from the others. Classification and Recognition here merge into one: or rather, there is no recognition of the individual, but only of the species. Suppose now, that the selected needle is a larger one than the rest. What follows? That it can be readily identified. Though it may be perfectly *similar* to the others—though the ratios of the several dimensions to each other may be exactly *like* the homologous ratios in the rest—though there may be complete equality of relations among the attributes; yet these attributes, separately considered, differ from the corresponding attributes in the others: and hence, the possibility of recognition. And in this case we see, not only the positive conditions under which only recognition can take place, but also the negative conditions. We see not only that the object identified must re-present a group of phenomena just like the group before presented; but also that there must be no other object presenting an exactly parallel group.

One further fact to be noticed is, that Recognition, in common with Classification, is a modified form of reasoning. It is not simply that reasoning is involved in cases where great change has taken place; as where a tree that has wholly outgrown recollection is identified, in virtue of its relative position to surrounding objects; but it is that where the recognition is of the simplest kind—where the recognized object is absolutely unaltered, there is still a ratiocinative act implied in the very predication of its identity. For what do we mean by saying of any particular thing, that it is the *same* which we before saw? And what suffices us as proof of the sameness? The conception indicated by the word *same*, is that of a perfectly definite

assemblage of correlated phenomena not *similar to* a before-known assemblage, but *indistinguishable from* a before-known assemblage. On perceiving a group of attributes answering in all respects to a group perceived on a previous occasion, and differing in some respects from all allied groups, we *infer* that there coexists with it a group of unperceived attributes that likewise answer, in all respects, to those previously found to coexist with the perceived group. And should any doubt arise as to the identity of the object, then, by more closely inspecting it, by feeling it, by examining its remote side, by looking for a particular mark before observed, we proceed to compare the inferred attributes with the actual ones: and should they agree, we say the object is the same. This is the sole content of our notion of sameness. Whilst from minute to minute throughout our whole lives we are presented with groups of phenomena differing more or less from all previous ones; we are also continually presented with groups of phenomena that are absolutely indistinguishable from groups before presented. Experience teaches us that when the perceived portion of one of these groups is indistinguishable from the corresponding portion of one before perceived; then, the remaining portions of the two are also indistinguishable. And the act of recognition is simply an inference determined by this general experience, joined to that particular experience which the recognition presupposes.

From all which it is manifest that, regarding them both as forms of reasoning, Recognition differs from Classification, simply in the greater speciality and definiteness of the inferred facts. Whilst, on the one hand, in classing an observed object as a book, the implied inference is, that along with certain visible attributes there coexist such others as the possession of white leaves covered with print; on the other hand, in the recognition of that book as So-and-so's Travels, the implied inference is, that these white leaves are covered with print of a particular size, divided into chapters with particular titles, containing paragraphs that express particular ideas. Thus the

likeness of relations involved in the intuition, is both more exact and more detailed.

§ 45. The general community of nature thus shown in mental acts called by different names, may be cited as so much confirmation of the several analyses. As, in preceding chapters, we saw that all orders of Reasoning—Deductive and Inductive, Necessary and Contingent, Quantitative and Qualitative, Axiomatic and Analogical—come under one general form; so here, we see both that Classification, Naming, and Recognition are nearly allied to each other, and that they also, are severally modifications of that same fundamental intuition out of which all orders of reasoning arise. Not only are Classification and Naming both of inferential nature; but they are otherwise allied as different sides of the same thing. Naming presupposes Classification; and Classification cannot be carried to any extent without Naming. Not only is it that Recognition and Classification are modes of ratiocination; not only is it that they often merge into each other, either from the extreme likeness of different objects, or the changed aspect of the same object; but it is that while Recognition is a classing of a present impression with past impressions, Classification is a recognition of a particular object as one of a special group of objects. And the weakening of these conventional distinctions—the reduction of these several operations of the mind, in common with all those hitherto considered, to variations of one operation, is to be expected as the natural result of analysis. For it is a characteristic of advancing science, continually to subordinate the demarcations which a cursory examination establishes; and to show that these pertain, not to nature, but to our language and our systems.

CHAPTER IX.

THE PERCEPTION OF SPECIAL OBJECTS.

§ 46. The several mental processes treated of in the last chapter, must be briefly glanced at under their obverse aspect. We analysed Classification and Recognition as particular forms of the act by which surrounding things become known to consciousness. It remains to be pointed out that surrounding things can become known to consciousness, only by acts of Classification or Recognition. Every perception of an external body involves a presentation of it to the mind as such or such—as a something more or less specific; and this implies, either the identification of it as a particular thing, or the ranging of it with certain like things. As there can be no Classification or Recognition of objects without Perception of them; so there can be no Perception of them without Classification or Recognition. Every complete act of perception implies an expressed or unexpressed "assertory judgment"—a predication respecting the nature of the perceived entity; and as is generally admitted, the saying what a thing *is*, is the saying what it is *like*—what class it belongs to. The same object may, according as the distance or the degree of light permits, be identified as a particular negro; or more generally as a negro; or more generally still as a man; or yet more generally as some living creature; or most generally as a solid body: in each of which cases the implication is, that the present impression is like a certain order of past impressions. The instances in which, from mental distraction, we go on searching for something we have in our hands, or overlook that which is directly under our eyes, clearly show that the mere passive reception of the visual image or group of sensations produced by an object, does not constitute a perception of it. A perception of it can arise only when the group of sensations

is consciously co-ordinated and their meaning understood. And as their meaning can be understood only in virtue of those past experiences in which similar groups have been found to imply such and such facts; it is clear that the understanding of them —the act of perception, involves the assimilation of them to those similar groups—involves the thinking of them as like those groups, and as having like accompaniments. The perception of any object, therefore, is impossible save under the form either of Recognition or Classification.

The only qualification of this statement, that may seem in strictness required, concerns cases in which some species of thing is presented to consciousness for the first time—cases, therefore, in which a thing is known not as *like*, but as *unlike*, the things previously known. Though, however, it may appear that there is here no Classification—seeing that there exists no previously-formed class—further consideration will show that there is a classification of a general, though not of a special kind. Suppose the object to be a new animal. Though in the act of perception it may not be thought of under the class, mammals, or the class, birds; it is still thought of under the class living beings. Suppose there is doubt whether the object is animate or inanimate. It is nevertheless, perceived as a solid body, and classed as such. The primary act then, is still a cognition of likeness of a more or less general kind; though there may subsequently arise a cognition of a subordinate unlikeness to all before-known things. Whether this law holds when we descend to the simplest kinds of cognition, it would be premature here to inquire; for at present we have to do only with those more complex cognitions, by which surrounding objects are severally distinguished in their totality. To cover all possible criticisms, however, the statement may be qualified by saying, that a special perception is possible, only as an intuition of the likeness or unlikeness of certain present attributes and relations, to certain past attributes and relations.

§ 47. It requires further to be observed, that the perception by which any object is known as such or such, is always what

is called an acquired perception. The truth exhibited at length in the last chapter—that Classification and Recognition are inferential acts—is even deducible from the current theory that inferences are implied in the interpretation of every group of sensations. All psychologists concur in the doctrine that most of the elements which go to make up the cognition of an observed object, are not known immediately through the senses, but are mediately known by an instantaneous and unconscious ratiocination. Before a mere visual impression can be developed into a perception of the thing causing it, there must be added in thought those attributes of solidity, trinal extension, size, quality of surface, &c. &c., which when united, constitute the nature of the thing as it is known to us. Though these seem to be given in the visual impression, it is demonstrable that they are not so; but have to be reached by inference. And the act of knowing them is termed acquired perception, to signify the fact that whilst really mediate, it appears to be immediate.

Not only, however, do the Classification and Recognition of individual objects imply acquired perceptions; but acquired perceptions are implied in the Classification and Recognition of those various actions and changes which objects exhibit. If an adjacent person at whose back we are looking, suddenly turns half round; the only thing immediately known is the sudden change in the character of the visual impression. Standing alone this change has no meaning; and comes to have one, only when by accumulated experiences it is found, that all such changes are accompanied by alterations in the relative positions of the parts, as ascertained by touch. We do not *see* the turning: we *infer* the turning. We conceive a certain relation between visual and mechanical changes *like* the numberless previously experienced relations; we *classify* the present relation with a series of past relations; and we signify it by a word *like* the words used to signify those past relations. The visible transformation which a piece of melting lead undergoes, can convey no knowledge, unless it is before known that certain appearances always coexist with fluidity. And what seems to be

a perception of the melting is, in reality, a rational interpretation of the appearances—a classing of them with the like appearances before known, and an assumption that they stand towards certain mechanical phenomena in relations parallel to the before-known ones. Endless illustrations to the same effect might be cited; but the above will suffice to indicate that those apparently simple though really complex cognitions, by which we guide ourselves from moment to moment, in the house and in the street—cognitions which chase each other through consciousness too rapidly even for enumeration—are all of them acquired perceptions; all of them involve the classification or recognition of attributes, groups of related attributes, and the relations between such groups; all of them embody inferences; all of them imply intuitions of likeness or unlikeness of relations.

§ 48. And here we see again illustrated, the fact, that the divisions we make between the various mental processes have merely a superficial truth. At the conclusion of Chapter VII. Reasoning was defined as the *indirect* establishment of a definite relation between two things; in contrast to Perception, in which the relation is established *directly*. But now we find that all those Perceptions by which complex objects become specifically known to us, also involve the indirect establishment of relations. Though, if uncritically received, the verdict of consciousness would seem to be, that on contemplating the lights and shades and perspective outlines of a building, the fact that it is a solid body is immediately known; yet analysis proves that its solidity is known mediately. And this analysis is fully confirmed by the stereoscope, which, by simulating the evidence of solidity, induces us to conceive as solid, that which is not solid. It would appear, therefore, that practically, the indirect is merged into the direct by long-continued habit. Just as the meaning of a word in a new language, though at first remembered only by the intermediation of the equivalent word in a known language, by and by comes to be remembered

without this intermediation; so, by constant repetition, the process of interpreting our sensations becomes so rapid, that we appear to pass directly to the facts which they imply. Still more manifest will appear the purely relative truth of this division, when it is observed, not only that what are known to be indirect cognitions become direct by habit, but that what seem unquestionably direct cognitions are united by insensible gradations with indirect ones. Thus, if I stand a hundred yards from the front of a house, the shape of that front seems to be known immediately: the relations of the parts are all directly presented to consciousness: nothing is inferred. But if I stand within a yard of the front and look up at it, the outlines, as then presented to my eye, are not in the least like those seen from a distance; and any conception which I may now form of the shape of the front, must be *inferred* from the greatly distorted outlines I see. Yet between a hundred yards and one yard, there are ten thousand points from which may be had as many views, each differing inappreciably from its neighbours. Evidently, then, the transition from the *directly* perceived shape to the *indirectly* perceived shape is insensible. And when to facts of this kind, we add the familiar fact that in reasoning we constantly skip the intermediate steps of an habitual argument, and pass at once from the premisses to a remotely involved conclusion—when we thus see that in conscious reasoning also, the tendency is for indirect processes to become more and more direct; it becomes manifest that from the most elaborate demonstration, down to the simplest intuition, the directness or indirectness with which the relation is established, is wholly a matter of degree; that the extremes are united by a series of insensible transitions; and that thus it is only relatively, and not absolutely, that Reasoning is distinguished from Perception by its indirectness.

CHAPTER X.

THE PERCEPTION OF BODY AS PRESENTING DYNAMICAL, STATICO-DYNAMICAL, AND STATICAL ATTRIBUTES.*

§ 49. THAT relation between object and subject which is established in the act of perception, is of a threefold kind. It assumes three distinct aspects, according as there is some species of activity on the part of the object; on the part of the subject; or on the part of both. If, while the subject is passive, the object is working an effect upon it—as by radiating heat, giving off odour, or propagating sound—there results in the subject, a perception of what is usually termed a secondary property of body; but what may be better termed a dynamical property. If the subject is directly acting upon the object by grasping, thrusting, pulling, or any other mechanical process; and the object is reacting, as it must, to an equivalent extent; the subject perceives those variously modified kinds of resistance which have been classed as the secundo-primary properties; but which I prefer to class as statico-dynamical. And if the subject alone is active—if that which occupies consciousness is not any action or reaction of the object, but something discerned *through* its actions or reactions—as size,

* The divisions thus designated, answer to those which Sir William Hamilton, in his valuable dissertation, classes as Secondary, Secundo-primary, and Primary. Whilst coinciding in the general distinctions drawn in that dissertation, I do so on other grounds than those assigned; and adopt another nomenclature for several reasons: partly because the names Primary, Secundo-primary, and Secondary, implying, as they in some degree do, a serial genesis in time, do not, as it seems to me, correspond with the true order of that genesis, subjectively considered, whilst, objectively considered, we cannot assign priority to any; partly because, as used by Sir William Hamilton, these terms have direct reference to the Kantian doctrine of Space and Time, from which I dissent; and partly because the terms above proposed are descriptive of the real distinctions between these three orders of attributes.

form, or position; then the property perceived is of the kind commonly known as primary, but here named statical.

The three classes of attributes thus briefly defined, which will hereafter be successively considered at length, are, for the most part, presented to consciousness, not separately, but together. Extension, and all the space-attributes, are unknowable, save through the medium of resistance and the other force-attributes. Tangible properties are generally perceived in connection with form, size, and position. And of the non-tangible ones, colour is mostly known as pertaining to the surfaces of solids; and cannot be conceived apart from extension of two dimensions. An object that is simultaneously held in the hands and regarded by the eyes, presents to consciousness all three orders of attributes at once. It is known as something resisting, rough or smooth, elastic or unelastic; as something having both visible and tangible extension, form, and size; as something whose parts reflect certain amounts and qualities of light; and, on further examination, as something specifically scented and flavoured.

In conformity with the method hitherto pursued, of taking first the most complex phenomena, resolving these into simpler ones, and these again into still simpler ones; our analysis of the perception of body will be best initiated by taking one of these total, exhaustive perceptions, and considering what are the relations that subsist among its various elements. And with a view of simplifying the problem, it will be well first to consider those *contingent* attributes known as secondary, and here called dynamical; so that after having duly analysed these in themselves, and in their relations to the *necessary* attributes, we may proceed to deal with the perception of necessary attributes as divested of everything that is extraneous.

§ 50. Beginning with these contingent attributes as contemplated in themselves, let us, in the first place, consider the propriety of classing them as dynamical. The most fami-

liar ones are obviously manifestations of certain forms of force. Of sound, we know, not only that it becomes sensible to us solely through vibrations of the *membrana tympani*—not only that these vibrations are caused by waves in the air; but we know that the body whence they proceed must be thrown into a vibratory state by some mechanical force — that it must propagate undulations through surrounding matter—and that in this purely dynamical action consists the production of sound. Respecting heat, we know, both that it may be generated mechanically, as by compression or friction; and that, conversely, it is itself capable of generating mechanical force: further, that in its reflections and refractions, it conforms to the law of composition of forces; whilst, by the now established undulatory theory, its multiplied phenomena are resolved into dynamical ones: and yet, further, that on holding a thermometer near the fire, the same agent which produces in us a sensation of warmth, produces motion in the mercury. The phenomena of colour, again, are reducible to the same category. The reflections and refractions of light are inexplicable, save mechanically; and only on the theory of undulations can polarization, diffraction, &c., be accounted for. In common with heat, light varies inversely as the square of the distance; as gravitating force does, and as every force proceeding in all directions from a centre must do. On the now currently received hypothesis of the correlation of the physical forces, light is regarded as one form of the primordial force, which may otherwise manifest itself as attraction, as sensible motion, as electricity, as heat, as chemical affinity. In the fact that high temperature produces luminosity, joined to the fact that high temperature may be generated mechanically, we clearly trace the transformation; whilst, conversely, we find light producing a dynamic effect, alike in all photographic phenomena, and in those changes of atomic arrangement which it causes in certain crystals. Add to which, that though, under ordinary circumstances, matter only reflects and modifies the rays falling upon it; yet under fit chemical conditions, it becomes an inde-

pendent source of light. Though not the immediate effects of radiant forces, odours are demonstrably dynamic in their origin. In conformity with the established doctrine of evaporation, that continuous giving off of particles in which odoriferousness consists, must be ascribed to atomic repulsion. And as the diffused molecules constituting the scent of a body, must have been propelled from the surfaces of that body, before they can act upon our nostrils; it follows that a certain form of activity in the object, is the efficient cause of a sensation of smell in the subject. The only secondary attribute of matter not obviously dynamic is that of taste. But the close alliance existing between taste and smell, is almost of itself sufficient to prove that if one is dynamic, so also is the other. Moreover, when we bear in mind that for a body to have any gustable property, implies some degree of solubility in the saliva, without which its particles cannot be carried by endosmose through the mucous membrane of the tongue, and cannot therefore be tasted; and when we further bear in mind that the diffusion of particles through liquid, is so far analogous to their diffusion through air, that the atomic repulsion causing the last, very probably has its share in the first; we shall see still further reason to consider the sensation of taste as due to an objective activity. But the dynamic nature of this, as well as of the other secondary attributes, is most clearly seen when, instead of contemplating the object as acting, we contemplate the subject as acted upon. An inappreciable quantity of strychnine, furtively conveyed into an infant's mouth, will produce a wry face; and, as all can testify, the flavours of certain drugs are so persistent as to continue to give us feelings of disgust, long after the drugs themselves have been swallowed. A pungent odour will cause a sneeze. The smell from a slaughterhouse or boneyard, creates a nausea that so tyrannizes over the consciousness, as to exclude every thought but that of escape. A flash of lightning, or any sudden change in the amount or quality of the light surrounding us, instantly changes the current of our thoughts. While sitting

alone, and perhaps diligently occupied, any such alteration in the distribution of light and shade as is produced by the movement of an adjacent body, even when quite on the outskirts of the visual field, will cause us to start and turn the head. And still more significant is the fact that a strong glare abruptly thrown upon his face, will often awaken a sleeping person. Similarly with the changes of temperature. Any one standing with his hands behind him cannot have a red-hot iron put close to them without his ideas being at once directed into a new channel. If the degree of heat passes a certain point, he will draw away his hands automatically; and a forced submission to such extreme degree of heat, produces both a violent nervous excitement and a violent muscular action. So, too, is it with sounds. They may create either pleasurable or painful states of consciousness: they often distract our attention against our will: when loud, they cause involuntary starts in those who are awake; and either waken those who sleep, or modify their dreams. If, then, in these extreme cases, the so-called secondary attributes of body are unquestionably dynamic, they must be so throughout. If we see the eyes made to water by mustard taken in excess; vomiting excited in squeamish voyagers by the smell of the cabin; a blinking of the eyes, and a painful sense of dazzling, caused by looking at the sun; a scream called forth by a scald or burn; and an involuntary bound produced by an adjacent explosion; it becomes an unavoidable conclusion that those properties of things which we know as tastes, scents, colours, temperatures, sounds, are effects produced in us by forces in the environment. The subject undergoes a change of state, determined in him by some external agency directly or indirectly proceeding from an object. Though, immediately after that change of state has been produced, there may arise in the subject, during the interpretation of its outward cause, various internally-determined states; yet, in so far as the change itself is concerned, the subject is simply recipient of an objective influence. In respect to all these so-called secondary

attributes, the object is *active* and the subject is *passive*. Or, in other words, they are *dynamical* attributes.

Let us next observe that, with the exception of taste, which is in some respects transitional, these dynamical attributes are those by which objects act upon us through space. By means of the light it radiates or reflects, an outward thing renders itself visible to us when afar off. Objects in a state of sonorous vibration arrest our attention at various degrees of remoteness. We are made aware of the presence of odoriferous substances whilst only in their neighbourhood. And masses of hot matter affect us not only when touching our bodies, but when near to them. Unlike hardness, softness, flexibility, brittleness, and all the statico-dynamical attributes, which are cognizable by us only through actual contact, either immediate or mediate; unlike the statical attributes, shape, size, and position, which do not in themselves affect us at all, but can become known only by acts of constructive intelligence; these dynamical attributes modify our consciousness at all distances from that of a star downwards. Eyes, ears, nose, and the diffused nervous agency enabling us to appreciate temperature, are inlets to the influences of objects more or less removed from us; and the ability that objects have thus to transmit their influence through space, again exhibits their inherent activity.

These attributes are further distinguished from all others by the peculiarity that they are, in a sense, separable from what we commonly call body; and may be perceived independently of it. Light in varying intensities is known as pervading surrounding space. The many tints assumed by the sky are not, in so far as our senses are concerned, the attributes of matter. And by casting the prismatic spectrum upon a succession of neighbouring surfaces, we may readily convince ourselves that colour, in its various qualities and degrees, exists apart from them. Again, the like holds good with respect to the relation between sounds and vibrating objects which we learn only by a generalization of experiences. To the incipient intel-

ligence of the infant, noise does not involve any conception of body. In an often-recurring echo, the sound has come to have an existence separate from the original concussion. We frequently hear sounds produced by things that are at the time neither visible nor tangible to us, but are simply inferred. And by the phrase,—"What 's that?" commonly uttered on hearing an unusual noise, it is clearly implied that the noise has been identified as such, whilst yet no object has been thought of as causing it. Odours, also, are often perceived when wafted far from the substances diffusing them. A room scented by something that has been placed in it, may retain the scent long after the thing has been removed. We may be strongly affected by an entirely new smell, whilst wholly ignorant what produces it, or from which side of us it comes. So, too, is it with heat. In a cloudy August we occasionally experience marked changes of temperature that are not traceable to any special object. The warmth of a room heated by hot-water pipes may be felt for some time before it is discovered whence the warmth proceeds. So even is it with gustable properties. Though ordinarily the things which we taste are simultaneously known to us as fluid or solid matters; yet it needs but to note the strong effects produced upon the tongue by pungent chemicals given in intangible quantities, or to remember the persistence of disagreeable flavours even after the mouth has been rinsed, to at once perceive that sapidity can be dissociated from body. Here again, then, the dynamical attributes stand apart from the statico-dynamical and statical ones; for none of those modifications of resistance constituting the one class, nor those tangibly perceived modes of extension constituting the other (visible extension being but symbolical of tangible extension), can be recognized apart from the objects to which they belong.

Note again that these dynamical or secondary attributes are incidental—that not only do different bodies exhibit them in all degrees and combinations, but that each body exhibits them more or less, or not at all, according as surrounding conditions determine. In the dark all things are colourless: in the light

their appearances vary as the light varies in kind and degree. The colour of a dove's neck changes with the position of the observer's eye: that of some crystals and fluids is reversed when the light is transmitted instead of reflected. Under ordinary circumstances most objects are silent: those that emit sound do so only under special influences: and the sound that any one of them emits is in great measure determined by the nature or intensity of the influences. A great number of bodies are inodorous; and of the rest, the majority cannot be perceived to have any smell, unless held quite close to the nostrils. Things that are almost scentless at low temperatures will become strongly scented at high ones; and things that have strong scents become for a time relatively scentless if continuously smelt at. Very many bodies have no taste whatever; and the sapid qualities of others vary according as they are hot or cold. The temperatures of things may be such as to give us sensations of greater or less heat; or such as to give us no appreciable sensations at all; or such as to give us sensations of greater or less cold: and things of the same temperature produce different impressions upon us according as they are good or bad conductors, and according as our temperature is high or low. Thus the incidental character of these attributes is manifest. To a person specially circumstanced, an object may be at once colourless, soundless, scentless, tasteless, and of such temperature as to produce no thermal effect upon him; or the object and the circumstances may be such that he shall be affected by one, or two, or three, or four, or all of these dynamic attributes in endless degrees and combinations. But it is otherwise with the statico-dynamical and statical attributes. For while different bodies present different amounts of resistance and extension; and while in the same body the resistance and extension admit of more or less variation; there is no body *without* resistance and extension.

Lastly, let it be noticed that these so-called secondary attributes of body, which we find distinguishable from the rest as being dynamical; as acting through space; as cognizable apart

from body; and as manifested by body only incidentally; are not, in any strict sense, attributes of body at all. It is not simply that being dissociable from body, body can readily enough be conceived without them; nor is it that what we call colour, sound, and the rest are subjective effects produced by unknown powers in the objects; but it is that these unknown powers are literally not in the objects at all. Rightly understood the so-called secondary attributes are every one of them manifestations of certain forces which pervade the universe in general; and which, when they act upon bodies, call forth from them certain reactions. On being struck, a gong vibrates; and by communicating its vibrations to the air, or any intermediate substance, affects an auditor with a sensation of sound. What now is the active cause of that sensation. It is not the gong: it is the force which, being impressed upon the gong, is changed by its reaction into another shape. Let the sun shine upon any mass of matter, and some of his rays will be absorbed while some are reflected. In most cases the light being decomposed, will, in its changed form, affect us as colour; and by special masses of matter it will be refracted or polarized. That is, a certain force emanating from the sun, impresses itself upon matter, and is, by the counter-action of matter, more or less metamorphosed. The heat given off by burning coal, by boiling water, and by a briskly hammered piece of iron, are so many reactions produced by external actions: in the first case by the chemical action of the surrounding oxygen; in the second by the action of neighbouring hot bodies; in the third by mechanical pressure. The slightly smelling substances around us, in common with the fluid extracts of the perfumer, are forced to send off their molecules by the heat which they receive from neighbouring objects. The atomic repulsion from which odoriferousness results, is one of the reactions consequent on the action of thermal force—is known to vary more or less as the thermal force varies; and could thermal force be altogether withdrawn, odours would cease. Throughout, therefore, these attributes are, if considered in their origin, activities pervading space; and can

be ascribed to body only in the sense that body when exposed to them, reacts upon them, modifies them, and by implication is known to us through these modifications. Properly understood, any one of these simple sensations of colour, sound, scent, and the rest, involves a series of actions and reactions of which the object proximately producing it, manifests but the last. The light, or mechanical force, or heat serving as its efficient cause, itself resulted from previous actions and reactions, which, if traced, lead us back into an indefinite past filled with like changes. But confining our attention to the elements with which we have immediately to deal, we see that rightly to understand one of these dynamic attributes, implies the contemplation of three things: first, a force, either diffused as light and heat, or concentrated as momentum; second, an object on which some of that force is impressed, and which, in so far as it is a recipient of force, is passive, but in so far as it reacts and determines that force into new forms and directions, is active; and third, a subject on whom some of the transformed force expends itself in producing what we term a sensation, and who, as the recipient of this transformed force, is passive, but who may be rendered active by it.

Strictly speaking, then, the so-called secondary attributes are neither objective nor subjective; but are the triple products of the subject, the object, and the environing activities. Sound, colour, heat, odour, and taste, can be called attributes of body, only in the sense that they imply in body certain powers of reaction which appropriate external actions call forth. These, however, are neither the attributes made known to us as sensations, nor those vibrations, or undulations, or atomic repulsions in which, as objectively considered, these attributes are commonly said to consist; but they are the occult properties in virtue of which, body modifies the forces brought to bear upon it. Nevertheless, it remains true that these attributes, as manifested to us, are dynamical. And, in so far as the immediate relation is concerned, it remains true that, in respect of these attributes, the object is active, and the subject is passive.

§ 51. Having thus gained a precise conception of these so-called secondary attributes, which we find to be dynamical; to act through space; to be separable from body; to be really environing activities modified by the reactions of body; and to be severally contingent both upon the special constitution of the body and its special circumstance; let us now proceed to define the perception which we have of a body presenting these non-necessary attributes, in conjunction with the necessary attributes: that is—a body as ordinarily perceived.

On taking up and contemplating an apple, there arises in consciousness, partly by presentation through the senses, and partly by representation through the memory, what seems to be one state; but what analysis proves to be an extremely complex group of many states, combined after a special manner. The greater number of these remain to be considered analytically in subsequent chapters; and can here be simply enumerated. Among them we have primarily, the coexistence in time of the contemplating subject and the contemplated object; we have further that relative position of the two in space which we call proximity; that group of impressions on the finger-ends, in virtue of which we conceive the object as not only having a position in space, but as occupying space, and a certain limited amount of space; that more complex group of tactile and motor impressions gained by moving the fingers about it, and constituting our notion of its tangible form; that supplementary group of impressions by which we recognize its surface as smooth; and that yet other group by which we form an idea of its hardness. Passing from these fundamental data acquired through the tactile and muscular senses, to those serving as symbols of them, we have to note the impressions through which the apple's coexistence in time and adjacency in space, are visually as well as tactually known; those which go to make up our conception of its visible bulk and figure; and those which indicate to us a correspondence between the data received through the eyes and those received through the fingers. But now, along with these statical and statico-dynamical attributes,

primarily known through variously modified and combined sensations of resistance and motion, and some of them re-known through certain combined ocular sensations of light, shade, and focal adjustment, we find certain other attributes standing in various orders of relation. Indissolubly joined with the visible attributes of position, size, and form, is that of colour (including in the word all possible modifications of light), recognized as coexistent in time and coincident in space with those statical attributes visually perceived by means of it. This relation admits of some variation however. For though, when our consciousness of colour entirely ceases, our consciousness of visible form, size, and place, ceases with it; yet by alterations in the amount and quality of the light, our impression of colour may be changed in various ways and degrees, and made almost to disappear, without any change being produced in our impressions of form, size, and place. The relation, though generically absolute, is specifically conditional. Observe now, however, that the relation of coincidence in time and space between the several impressions we have of the visible attributes, and those we have of the tangible ones, is entirely conditional. It depends on the presence of light; on the opening of the eyes; and on the object being within the field of view. Unless each of these three conditions is fulfilled, no relation of coincidence in time and space between these two sets of attributes, can be established. Similarly with the odour. This, being but weak, cannot be known as accompanying the other attributes, unless the apple be placed close to the nostrils and air be drawn in. The presence of a certain taste is in like manner unknowable, save through actions similarly special. Thus, the common characteristic of the dynamical attributes, as perceived to coexist with the statico-dynamical and statical ones, is, the extreme conditionality of their coexistence, in so far as our consciousness is concerned. Though our perceptions of the softness, roughness, flexibility, &c. of any body examined by the fingers, are conditional, both upon the nature of the body and upon our performance of certain mani-

pulations; yet the general perception of resistance is wholly unconditional. Though our perceptions of the specific extension of the body—its size and shape—are similarly conditional upon its character and upon our acts; yet the general perception of extension is wholly unconditional. *Some* resistance and *some* extension are the invariable and necessary elements of the cognition. Be the body what it may, and be the part of our surface which it touches what it may, if it is perceived at all, it is perceived as something resisting and extended. But the perception of the dynamical attributes as coexistent with the rest, is conditional, not only upon the nature of the object and upon our acts, but also upon the exposure of the object to certain agencies pervading the environment.

Hence then, leaving out details, any total perception in which the three orders of attributes are jointly known, is a composite state of consciousness in which, along with certain general impressions of resistance and extension, *unconditionally* standing to each other and the subject in relations of coexistence in time and adjacency in space; and along with certain specialized impressions of resistance and specialized impressions of extension, *conditionally* standing to each other and the subject in similar space-relations, and slightly modified time-relations; there are presented certain further impressions, standing in a *doubly conditional* manner to the previous ones, to the subject, and to each other, in space and time relations still further modified. This definition must not, however, be taken as anything like an accurate or exhaustive one: for nothing is said of all the inferred facts inextricably bound up with the perceived ones; nothing of those many minor conditions and accompaniments, to describe which completely would take pages. It is intended simply to exhibit, in as precise a way as the present stage of the analysis admits, the general mode in which our cognitions of the several orders of attributes are united in ordinary perception—simply to display the relationship in which, as known to us, the dynamical attributes of body stand to its other attributes: so that having duly contem-

plated the connection, we may go on to analyze the perception of the statico-dynamical and statical attributes by themselves.

§ 52. The mental operation, however, by which one of these perceptions is effected, still remains to be described. So far, we have considered only the several elements which compose the perception; and there has yet to be considered the process by which they are co-ordinated. This is what may be termed a process of *organic classification.*

As explained in preceding chapters, the "assertory judgment" involved in every perception of an object, is an act of either classification or recognition. The perception, according as it is more or less specific, involves the thought,—"This is a dog;" or, "This is something alive;" or, "This is a solid body." It is not requisite that the assertory judgment should be verbally expressed, either outwardly or inwardly; but that the perceived object must be more or less consciously referred to its class, is manifest from the fact, that when, after some ordinary thing has been put under his eyes, a person cannot subsequently tell what it was, we say that he did not perceive it. Though he received all the needful impressions, he did not so attend to them as to become conscious of what they imported. Had he done so, his subsequent ability to name the thing would imply that, verbally or not verbally, he had recognized its nature; that is, its class. Now this semi-conscious classification which every complete perception of an object involves, *is necessarily preceded by a still less conscious classification of its constituent attributes, of the relations in which they stand to each other, and of the conditions under which such attributes and relations become known.* At first sight, this will appear to be an incredible proposition—incredible both as asserting what self-analysis gives no evidence of, and as implying a mental activity inconceivably rapid. Nevertheless, inquiry will show both that, *à priori*, the perception of an object is not otherwise possible,

and that direct experience, not less than analogy, implies that some such spontaneous assimilation takes place.

Observe first the necessities of the case. If, instead of that which I perceive to be an apple, there had been presented something having like form and colours, but measuring a yard in diameter; I should not have concluded it to be an apple. Or if, while the bulk and colours were as usual, the form were cubical or pyramidal; I should certainly have regarded it as something else than an apple. And similarly, if, though like in other respects, it were sky-blue; or covered with spines; or as heavy as lead. What now is implied by these facts? Clearly it is implied that before the object is recognized as an apple, each of the chief constituent attributes is recognized as *like* the homologous attribute in other apples. The bulk is perceived to be like the bulk of apples in general; the form like their forms; the colour like their colours; the surface like their surfaces; and so on: that is, each of the several elements constituting the total perception, is classed with the before-known like elements; just as the entire group of elements is afterwards classed with the before-known like groups. Moreover, there is a classing not only of the constituent attributes, but of their relations. If the apple be one marked with streaks of red; then it is requisite that these should run in certain directions. Were they to run equatorially, it would be at once decided that the object was not an apple; as also, if the stem and the remnant of the calyx did not stand towards each other, and towards the rest of the mass, in specific positions. That is, the relations of coexistence, and proximity, and arrangement, subsisting among the constituent attributes, must also be recognized as like certain before-known relations—must be classed with them. And yet further, not only must the attributes and relations be thus classed, but also the conditions under which they become known. The colours and visible form of an apple being perceivable only during the presence of light, it results that a cognition of its presence,

regarded as a condition like the before-known conditions, becomes an indirect component of the perception: to prove which, it needs but remember that the form and colours of an apple, if seen in the dark, would be regarded not as an apple, but as an optical illusion. Its weight, again, is perceived as coexistent with its tangible properties; but only when it is lifted: and no sensation of weight, save one obtained under this condition, like certain remembered conditions, could be ascribed to the apple, or become an element in the perception of it. Thus then, there is a classing of the several attributes, with the like foreknown attributes; of the relations subsisting among them, with like foreknown relations; and of the conditions under which they are perceived, with like foreknown conditions. And the classification of the object as an apple is the cumulative result of these constituent classifications.

"But how," it will be asked, "is it possible that such a complicated group of mental acts should be performed so rapidly as to leave no trace in our consciousness?" I have already, by using the phrase "*organic* classification," indicated what I conceive to be the solution of this difficulty; and it needs but to glance at the phases through which our acts of classing pass from the conscious to the unconscious, to see that the facts point to this solution. Let any one walking through the Zoological Gardens, meet with an animal he has not before seen, but knows only by description. By what process does he endeavour to determine its kind? He considers its separate characteristics—thinks successively of its size, its general shape, its head, its feet, its tail, its hair, its colour, its walk and actions—classes these respectively as large, as broad, as pointed, and so forth—does, in a less definite way, what a zoologist in a parallel case does systematically; and if he succeeds in classing the creature, does so by thus thinking of the likeness of its constituent parts to those of creatures he has heard of, read of, or seen drawings of. Let him now pass on to some before seen, but not familiar creature, as the hippopotamus. His first sight of it is accompanied by a distinct act of classing; and by a

repetition of the name, either aloud or to himself. Let him walk by those cages whose inmates he has often seen, as the lions, and the act of classing will obtrude upon his consciousness much less distinctly. Let him leave the gardens, and though, on passing the horses standing at the gates, he will be conscious that they are horses, he will not specifically identify them as such in any deliberate act of thought. And when he reaches the crowded thoroughfares, though each of the hundred individuals passing him every minute is distinguished as man, woman, boy, or girl, or is classed, the mental act is yet performed so rapidly, so automatically, as scarcely to interrupt the current of his thoughts. Now this ever-increasing facility and quickness in classing complex groups of attributes, implies an ever-increasing facility and quickness in that classing of the attributes themselves, their relations and conditions, which begins with the first days of infancy. Forms, sizes, distances, colours, weights, smells, and the rest, though once consciously classed, gradually during childhood come to be classed less and less consciously; and this classification beginning as it does earlier than any other, being most frequently repeated, and in its nature much simpler, necessarily grows more rapid, more automatic, more organic than any other; and eventually becomes imperceptible to consciousness.

But this view of the matter will be most clearly realized, when each remembers that he has, within his own experience, a case in which the entire progress from conscious to unconscious classification is traceable. When learning to read, the child has to class each individual letter by a distinct mental act. This symbol A, has to be thought of as like certain others before seen; and as standing for a sound like certain sounds before heard. By continued practice these processes become more and more abbreviated and unconscious. Presently the power is reached of classing by one act a whole group of such symbols—a word; and eventually an entire cluster of such words is taken in at a glance. Now, were it not that these steps can be recalled, it would seem absurd to say that when the

reader, by what appears almost a single cognition, takes in the sentence—"This is true," that he not only classifies each word with the before-known like words, but each letter with the before-known like letters. Yet, as it is, he will see this to be an unavoidable inference. For, as it is undeniable that such acts of classing were performed at first; and as no time can be named at which such acts were given up; it follows that the entire change has arisen from their immensely increased rapidity—from their having become automatic or organic. And if this result has taken place with acts of classing that were commenced so late as five or six years old, still more must it have taken place with those much simpler ones which were commenced at birth.

Hence, therefore, the foregoing definition of the perception of body as presenting the three orders of attributes, requires to be supplemented by the explanation, that the several attributes, the relations in which they stand to each other and the subject, and the conditions under which only such attributes and relations can be perceived, have to be thought of as like before-known attributes, before-known relations, and before-known conditions.

CHAPTER XI.

THE PERCEPTION OF BODY AS PRESENTING STATICO-DYNAMICAL AND STATICAL ATTRIBUTES.

§ 53. If we imagine a human being without sight, hearing, taste, smell, or the sense of temperature, and having no channels through which to receive impressions of the outer world, save the tactile and muscular senses; then the only attributes of body cognizable by him, will be the statico-dynamical and the statical. All the knowledge which he can gain of things, by touching, pressing, pulling, and rubbing them, and by moving his limbs or body, or both, in contact with them, comes under these heads: the one comprehending that knowledge gained by an activity on his part, and a reactivity on the part of the things; the other comprehending that knowledge gained by his independent internal activity in putting together certain of the impressions he has received,—knowledge in respect of which the things themselves are altogether passive.

These statico-dynamical and statical attributes of body are usually presented to consciousness closely united. When in the dark any object is examined by the hands, more or less definite perceptions of its softness, smoothness, elasticity, &c., are joined with more or less definite perceptions of its position, size, and form. These two classes of perceptions may accompany each other with various degrees of incompleteness: but *some* connection between them is invariable. As will hereafter be shown, it is questionable whether primordially they are perceived in this relation; but without doubt by the adult human consciousness, all tactile resistances are unconditionally known as coexistent with *some* extension; and all tactile

extensions are unconditionally known as coexistent with *some* resistance.

In pursuance of the method hitherto followed, we have now to analyze one of these complex tactile perceptions in its totality. And as in the last chapter we directed our attention mainly to a certain contingent class of attributes, and their relations to these essential ones, with a view of subsequently leaving them out of consideration; so here, it will be best to treat more especially of the resistance-attributes, so that having examined the mode in which we perceive them and their relations to the extension-attributes, we may proceed to deal with the extension-attributes by themselves.

§ 54. Observe in the first place, why these resistance-attributes which have been termed secundo-primary, may be more appropriately termed statico-dynamical. They are all of them known as manifestations of mechanical force. They are all, considered in themselves, the results of attraction, or repulsion, or that property of body in virtue of which its reaction upon a disturbing agent varies as the quantity of motion which that disturbing agent impresses upon it.* They are the attributes of body involved alike in its standing and in its acting. That capacity which matter has of passively retaining, while undisturbed, its size, figure, and position, may rightly be regarded as statical; while that capacity which it has of opposing a counteracting force to any force brought to bear upon it, must be

* I use this awkward circumlocution to avoid an inaccuracy. Among the sources, physically considered, of the secundo-primary attributes, Sir William Hamilton enumerates *inertia*. But inertia is not a force: it is simply the negation of activity. It is not a positive attribute: it is a purely negative one. There is a very general belief that matter offers some absolute opposition to anything tending to displace it. This is not the fact. Take away all extrinsic hindrance—all friction, all resisting medium—and an infinitesimal force will produce motion; only the motion will be infinitesimal, in consequence of the law that the velocity varies as the momentum (or force impressed) divided by the mass. Were inertia a force, all the calculations of astronomers respecting planetary perturbations and the like, would be erroneous. The term *vis inertiæ* is a misnomer.

considered as dynamical; and the fact that these capacities cannot be dissociated, but are two sides of the same capacity, is expressed by uniting the descriptive terms. The duality of aspect demands duality of name. Add to this, that if we class those attributes in respect of which the object is active while the subject is passive, as dynamical; and if we class as statical, those in respect of which the subject is active while the object is passive; then we must class as statico-dynamical, those in respect of which subject and object are both active.

These attributes that have for their common element some manifestation of mechanical force, and that are severally known to us through impressions of which resistance is the essential element, are more numerous than would be supposed. The opposition which objects offer to force tending to raise them—their weight—originates only the attributes of *Heavy* and *Light;* which simply indicate certain relative amounts of gravitative force. But the opposition which objects offer to compression or extension, is distinguishable, not only in its relative amounts, but in its kinds. Of bodies that resist in different modes as well as in different degrees, we have the *Hard* and *Soft;* the *Firm* and *Fluid;* the *Viscid* and *Friable;* the *Tough* and *Brittle;* the *Rigid* and *Flexible;* the *Fissile* and *Infissile;* the *Ductile* and *Inductile;* the *Retractile* and *Irretractile;* the *Compressible* and *Incompressible;* the *Resilient* and *Irresilient;* and (combined with figure) the *Rough* and *Smooth.** Of these pairs of attributed qualities, several

* With some exceptions this is Sir William Hamilton's classification. I do not, however, separate, as he attempts to do, the atributes which (physically considered) imply atomic attraction (as the Retractile) from those which imply atomic repulsion (as the Resilient); because, in reality, all of them imply both. As there is a balance of the molecular attractions and repulsions in an undisturbed body, so, a body cannot have any of its atoms disturbed by an external force, without both the attractive and repulsive forces coming into active opposition. On examining the fracture of a piece of wood broken transversely, part of the area will be seen to exhibit marks of tension, and part of compression (in wood about $\frac{3}{8}$ and $\frac{5}{8}$ respectively); and the line dividing these areas is called the "neutral axis." A body cannot exhibit ductility or retractility without being partially thrown into a state of compression; seeing that, until parts are compressed, the extending force cannot be applied to the body.

are purely relative—are simply degrees of the same. This is manifestly the case with *Hard* and *Soft, Firm* and *Fluid, Compressible* and *Irrecompressible.* But there are some, as *Ductile* and *Inductile,* which are not united by insensible gradations.

To determine the modes in which we perceive these attributes, it is requisite that we should first consider the several distinct sensations resulting from the direct action of body upon us; together with those which accompany our direct action upon body. There are two in respect of which body is active, and we are passive; and two in respect of which we are active and body is passive. Those which we may class as of objective origin, are the sensations of *touch* and *pressure:* those which originate subjectively are the sensations of *muscular tension* and *muscular motion.* Let us consider them seriatim.

When one of the fingers is brought very gently in contact with anything; or when a fly settles upon the forehead, or a hair gets into the mouth; we have the sensation of *touch proper.* This sensation is undecomposable—is not accompanied by any sensation of pressure; and though we always ascribe it to some object capable of exercising more or less resistance, we cannot properly say that the resistance is given in the sensation. Though we know the sensation to be caused by mechanical force, it is not immediately, but mediately, that we know this. Mechanical force is immediately knowable to us only as that which opposes our muscular action; and as, in this case, muscular action is not called forth, mechanical force can only be inferred.

If the hand be opened out upon the table, and a weight be placed on one of the fingers, there results the sensation of *pressure,* which is clearly distinguishable from the last. In most of our tactile impressions, the two are so mixed as to be with difficulty discriminated. But if we compare the feeling caused by a fly on the forehead, with that caused by a weight on the finger, we shall perceive that no increase in the intensity of either will produce the other. And that the two differ not

in degree but in kind, will be yet more clearly seen on remembering that the sensation of tickling, which a continuity of touch proper produces, is the strongest when the touch is extremely light; and that when the touch becomes heavier, the sensation of tickling wholly ceases, and is replaced by another. Contrasting them physiologically, we may presume that the sensation of touch proper results from a stimulation of the nerves of the skin, while that of pressure results from a stimulation of nerves in the subjacent tissues; that hence, by very gentle contact the nerves of the skin are alone affected, while by a rougher contact the nerves of both are affected; that consequently, in passing from gentle to rough contact by degrees, the single feeling at first experienced becomes masked by another feeling that arises by insensible gradations; and that thus results the habitual confusion of the two. It remains to be noticed that the sensation of pressure, though often associated with that of muscular tension, often exists apart from it; as in the example above given, and as in our ever-present experience of the reactive pressure of the surface supporting our bodies.

The sensation of *muscular tension* also, is capable of existing separately from the others. On raising the arm to a horizontal position and keeping it so, and still more on dealing similarly with the leg, a sensation is felt, which, tolerably strong as it is at the outset, presently becomes unbearable. If the limb be uncovered, and be not brought against anything, this sensation is associated with no other, either of touch or pressure.

Allied to the sensation accompanying tension of the muscles, is that accompanying the act of contracting them—the sensation of *muscular motion*. Concerning the state of consciousness induced by muscular motion, and concerning the ideas of Space and Time which are connected with it in adult minds, something will be said hereafter. For present purposes it will suffice to notice, that while, from the muscles of a limb at rest no sensation arises; while from the muscles of

a limb in a state of continuous strain, there arises a continuous sensation which remains uniform for a considerable time; from the muscle of a limb in motion, there arises a sensation which is ever undergoing increase or decrease or change of composition.

The several sensations thus distinguished, and more particularly the last three, are those which, by their combination in various degrees and relations, constitute our perceptions of the statico-dynamical attributes of body. Let us consider some of these perceptions as thus constituted.

§ 55. When we express our immediate experiences of a body by saying that it is *hard*, what are the experiences implied? First, a sensation of pressure of considerable intensity is implied; and if, as in most cases, this sensation of pressure is given to a finger voluntarily thrust against the object, then there is simultaneously felt a correspondingly strong sensation of muscular tension. But this is not all: for feelings of pressure and muscular tension may be given by bodies which we call soft, provided the compressing finger follows the surface as fast as it gives way. In what then consists the difference between the perceptions? In this; that whereas when a soft body is pressed with increasing force, the synchronous sensations of increasing pressure and increasing muscular tension are accompanied by sensations of muscular movement; when a hard body is pressed with increasing force, these sensations of increasing pressure and tension are *not* accompanied by sensations of muscular movement. Considered by itself then, the perception of softness may be defined as the establishment in consciousness of a relation of simultaneity between three series of sensations—a series of increasing sensations of pressure; a series of increasing sensations of tension; and a series of sensations of motion. And the perception of hardness is the same with omission of the last series. As, however, hardness and softness are names for different degrees of the same attribute, these definitions must be understood in a relative sense.

Take again the attribute of *resilience*, as displayed in such a body as indian rubber. The perception of it manifestly includes as one component, the perception of softness; but it includes something more. While, when the finger is thrust against some soft but irresilient body, as wet clay, the three simultaneous series of sensations of pressure, tension, and motion, are followed (on the withdrawal of the finger) by sensations of motion only; when it is thrust against a piece of indian rubber, these three simultaneous series of sensations are followed by three other series in the reverse order. Following the retiring finger, the indian rubber gives a decreasing series of sensations of pressure, and a decreasing series of sensations of tension. Thus the perception of resilience is definable as the establishment in consciousness, of a relation of sequence between the group of co-ordinated sensations constituting the perception of softness, and a certain other group of co-ordinated sensations similar in kind but opposite in order.

The perceptions of *roughness* and *smoothness*, referring as they do, not to the degree or kind of cohesion subsisting among the particles of a body, but to the quality of its surface, have little in common with the foregoing. The motion by which either of them is gained, is not in the line of pressure; but at right angles to it. The accompanying sensations of pressure, or of touch proper, do not form either an increasing or a decreasing series; but are either uniform (as when smoothness is perceived) or irregularly varied (as when roughness is perceived). The perception of smoothness, then, consists in the establishment in consciousness of a relation of simultaneity between a special series of sensations of motion, and a uniform sensation of touch proper, or pressure, or both. While in the perception of roughness, the like sensations of motion are known as simultaneous with a broken series of sensations of touch, or pressure, or both.

It is as unnecessary as it would be tiresome, thus to analyze our perceptions of all the statico-dynamical attributes above enumerated. What has been said renders it sufficiently mani-

fest, that they severally consist in the establishment of relations of simultancity and sequence among our sensations of touch, pressure, tension and motion; experienced as increasing, decreasing or uniform; and combined in various modes and degrees: and this is all which it here concerns us to know.

§ 56. Passing from these preliminary analyses to the general subject of the chapter—the perception of body as presenting statico-dynamical and statical attributes, or in other words—the perception of body obtained through the tactile and motor organs alone; we find that it is made up of the following elements. The relations between subject and object, of coexistence in time and adjacency in space; the combined impressions which make up our ideas of a more or less specific size and a more or less specific shape; the further impressions included in our notions of surface; those included in our notions of texture; and those many others signified by the terms ductility, elasticity, flexibility, &c.—all of them referred to one place in time and space. Not to dwell upon these several constituents of the perception, which were to some extent incidentally described in the last chapter, it now remains to specify more definitely than before, the kind of union subsisting among them. When in the dark the presence of some object is revealed to us by accidental collision, we have, along with certain unexpected sensations of pressure and muscular tension, a more or less vague conception of a something extended; and, as previously explained, this relation of coexistence between resistance and extension is unconditional—is independent alike of the will of the subject and the quality of the object. But if the nature of the object is to be ascertained, its reactions must be called forth by certain appropriate actions of the subject. The sensations it gives us must become known as sequent to certain sensations we give ourselves. There must be particular kinds of volition and the particular changes of internal state that follow them, before the changes resulting from external impressions can be received.

It is true that some of the resistance-attributes, as hardness and softness, usually become involuntarily known in the act of collision; though this is not necessary, seeing that when moving with outstretched hands, the gentlest touch suffices to prove to us that there is *something*, before yet we can know aught of its nature. But to determine whether the body is rough or smooth, flexible or rigid, ductile or inductile, &c. manifestly presupposes subjective activities of a complicated kind: and the modifications of consciousness accompanying these, must become essential elements of the perceptions. Hence, a statico-dynamical attribute is perceived through a union of internally-determined impressions with externally-determined impressions; which combined group of impressions is known as the consequent of those internally-determined impressions constituting volition.

Defined in its totality then, the perception of body as presenting statico-dynamical and statical attributes, is a composite state of consciousness, having for its primary elements the impressions of resistance and extension *unconditionally* united with each other and the subject in relations of coincidence in time and adjacency in space; having for its secondary elements the impressions of touch, pressure, tension, and motion, variously united with each other in relations of simultaneity and sequence that are severally *conditional* on the nature of the object and the acts of the subject, and all of them *conditionally* united with the primary elements by relations of sequence; and having for its further secondary elements certain yet undefined relations (constituting the cognitions of size and form, hereafter to be analyzed), which are also *conditionally* united alike with the primary elements and the other secondary elements.

Such being the *constituents* of the perception, it only requires to remind the reader that, as shown at length in the last chapter, the *act* of perception consists in the classing these constituents, each with others of its own order. No one of them can be known for what it is, without being assimilated to

the before-known ones which it resembles. And from the classing of each impression with like remembered impressions; each relation with like remembered relations; and each condition with like remembered conditions; results that classing of the object in its totality which is synonymous with a perception of it.

CHAPTER XII.

THE PERCEPTION OF BODY AS PRESENTING STATICAL ATTRIBUTES.

§ 57. From that class of attributes known to us solely through one or other kind of objective activity; and from that further class known to us through some objective reactivity called forth by a subjective activity; we now pass to that remaining class known to us through a subjective activity only. In respect of its space-attributes—Bulk, Figure, and Position—body is altogether passive: and the perception of them is wholly due to certain mental operations, certain acts of thought. Unlike heat, sound, odour, &c., which are presented to consciousness by no acts of our own, but often in spite of them—unlike roughness, softness, pliability, &c., of which we become conscious by the union of our own acts with the acts of things; the phenomena of extension in their several modifications, are cognizable entirely through an internal co-ordination of impressions: a process in which the extended object has no share. Though the data through the interpretation of which its extension is known, are supplied by the object; yet, as those data are not the extension; and as until they are combined in thought the extension is unknown; it follows that extension is an attribute with which body does not impress us, but which we discover through certain of its other attributes. To an uncritical observer, the visible outlines of an object will perhaps seem to be as much thrust upon his consciousness by the object itself, as its colour is. But on remembering that these visible outlines are revealed to him only through certain modifications of light; that these modifications are produced not by the outlines, but by certain occult properties of the substance having

these outlines; and that were these occult properties absent the outlines would be invisible; it will be seen that the outlines are known not immediately but mediately. And when it is further remembered that in the absence of light, the outlines of an object are knowable only through a series of tactile and muscular sensations gained by acts of exploration; and that consciousness of the outlines depends on the thinking of these in certain relations; it will no longer be questioned that in the perception of the space-attributes, the object is wholly passive, and the subject alone is active.

The propriety of distinguishing Bulk, Figure and Position as statical attributes, may perhaps be questioned: seeing that as applied in mechanics to signify respectively the phenomena of forces that produce equilibrium, and the phenomena of forces that produce motion, statics and dynamics are allied in nature, and pass the one into the other by insensible steps; whereas the attributes that are here classed as statical, differ wholly and irreconcilably from those classed as dynamical. The reply is, that the terms as now used are to be understood, not in the mechanical sense, but in a more general sense. The statical attributes are those which pertain to body as standing or existing. The dynamical ones are those which pertain to it as acting. Since it will not be denied that the so-called secondary attributes of body, which, as we find, imply its activities, are rightly termed dynamical; it must be admitted that the so-called primary ones, which, as implying passivity, are their antitheses, may be properly distinguished as statical.

§ 58. Whether the space-attributes of body are any of them knowable through the eyes alone, has been a disputed question. That our perceptions of distance are not originally visual, but result from muscular experiences, which visual ones serve to symbolize, is admitted. And that at least one out of the three dimensions of body, involving as it does the idea of greater or less remoteness from us, can be known only through muscular experiences, must also be admitted. But our inability

to conceive of colour save as having extension of two dimensions, seems to imply that superficial magnitude is to a certain extent knowable by sight. Though it is perfectly manifest that superficial magnitude as known by sight, is purely relative—that the same surface, according as it is placed quite close to the eye or a quarter of a mile off, may occupy the whole field of view, or but an inappreciable portion of it; yet as, while an object is visible at all, it must present *some* length and breadth, it may be argued that superficial extension *in the abstract,* is originally perceivable through the eyes, as much as colour is. This conclusion, however, may be proved erroneous.

A little thought will show, that visible superficial extension is inconceivable without a simultaneous conception of distance. Imagine a surface a foot square to be placed a yard from the eye, at right angles to the axis of vision; and imagine further that four straight lines are drawn from its angles to the centre of the eye. Suppose now that a surface of six inches square be interposed at half the distance, so as to subtend to the eye the same apparent area; and that another of three inches square be interposed between this and the eye in the same manner; and so on continuously. It is manifest that were it possible to repeat this process *ad infinitum,* the area subtended by the four converging lines would disappear at the same moment that the distance from the point of convergence disappeared; and that hence, all our experiences conforming as they must to the laws of convergent rays, we can have no conception of a visible superficies without an accompanying conception of a distance between that superficies and the sentient surface. Or, to state the case more simply, and at the same time to avoid certain objections that may else be made—superficial extension cannot be conceived, except as the attribute of something separate from consciousness—something belonging, not to the mind, but to an object out of the mind. That is to say, it implies the idea of outness; or in other words the idea of distance. Hence, as it is admitted that distance is

knowable only through experiences of motion, it follows that visible extension also, is knowable only through such experiences.

But a clearer understanding of the matter will be obtained, if we consider what is really given in a visual impression. The retina, as examined microscopically, presents, among other elements, a tesselated pavement made up of minute rods packed side by side, with their ends exposed so as to form its surface. As far as can be made out, each of these rods is supplied by a separate nerve; and is, as must be supposed, capable of independent stimulation. Though the hypothesis is not without difficulties, yet it is hardly doubted that these are the agents through whose joint action our visual impressions of form, &c., are obtained. That this joint action may be the more easily comprehended, let us suppose an analogous structure on a large scale. Imagine that an immense number of fingers could be packed side by side, so that their ends made a flat surface; and that each of them had a separate nervous connection with the same sensorium. If anything were laid upon the flat surface formed by these finger-ends, an impression of touch would be given to a certain number of them—a number great in proportion to the size of the thing. And if two things successively laid upon them differed not only in size but in shape, there would be a difference not only in the *number* of finger-ends affected, but also in the kind of *combination*. But now, what would be the interpretation of any impression thus produced, while as yet no experiences had been accumulated? Would there be any idea of extension? I think not. To simplify the question, let the first object laid upon these finger-ends be a straight stick; and let us name the two finger-ends on which its extremes lie A and Z. If now it be said that the length of the stick will be perceived, it is implied that the distance between A and Z is already known; or in other words, that there is a pre-existent idea of a special extension: which is absurd. If it be said that the extension is implied by the simultaneous excitation of B, C, D, E, F,

and all the fingers between A and Z, the difficulty is not escaped; for no idea of extension can arise from the simultaneous excitation of these, unless there is a knowledge of their relative positions; which is itself a knowledge of extension. By what process then can the length of the stick become known? It can become known only after the accumulation of certain experiences, by which the series of fingers between A and Z becomes known. If the whole mass of fingers admits of being moved bodily, as the retina does; and if, in virtue of its movements, something now touched by finger A is next touched by finger B, next by C, and so on; and if these experiences are so multiplied by motion in all directions, that between the touching by finger A and by any other finger, the number of intermediate touches that will be felt is known; then the distance between A and Z can be known—known, that is, as a series of states of consciousness produced by the successive touchings of the intermediate fingers—a series of states comparable with any other such series, and capable of being estimated as greater or less. And when, by numberless repetitions, the relation between any one finger and each of the others is established, and can be represented to the mind as a series of a certain length; then we may understand how a stick laid upon the surface so as at the same moment to touch all the fingers from A to Z inclusive, will be taken as equivalent to the series A to Z—how the *simultaneous* excitation of the entire range of fingers, will come to stand for its *serial* excitation—how thus, objects laid upon the surface will come to be distinguished from each other by the relative lengths of the series they cover; or when broad as well as long, by the groups of series which they cover—and how by habit these simultaneous excitations, from being at first known indirectly by translation into the serial ones, will come to be known directly, and the serial ones will be forgotten: just as in childhood the words of a new language, at first understood by means of their equivalents in the mother tongue, are presently understood by themselves; and if used to the exclusion of the mother tongue, lead to the

ultimate loss of it. The greatly magnified apparatus here described, being reduced to its original shape—the surface of finger-ends being diminished to the size of the retina; the things laid upon that surface being understood as the images cast upon the retina; and its movements in contact with these things, as the movements of the retina relatively to the images —some conception will be formed of one part of the process by which our ideas of visual extension are gained.

I say one part of the process, because this analysis carries us but a little way towards the solution. Those motions of the eye required to bring the sentient elements of the retina successively in contact with different parts of the image, being themselves known to consciousness, become components of the perception. So too do those motions required to produce due convergence of the visual axes; and those further motions required to adjust each eye to the proper focus. And even when the several series of states of consciousness thus resulting, have been combined with those which proceed from the retina itself, they can give no idea of extension as we understand it, until they are united with those locomotive experiences through which we gain the idea of outness or distance; and these are impossible without those accompanying tactile experiences that give the limits to distance. To examine in detail these various groups of elements which go to make up our perception of visible extension, would take up more space than can here be spared. Nor is it needful for the establishment of general principles that they should be thus examined. The foregoing analysis shows that leaving out of view other requirements (all of which involve motion, and the accompanying states of consciousness), no image cast upon the retina can be understood, or even distinguished from another image widely different in form, until relations have been established between the separate sensitive agents of which the retina is constructed; that no relation between any two such agents can be known otherwise than through the series of sensations given by intervening agents; that such series of sensations can be obtained only by motion

of the retina; and that thus the primitive element out of which our ideas of visible extension are evolved, is a cognition of the relative positions of two states of consciousness in some series of such states consequent upon a subjective motion. Not that such relation between successive states of consciousness gives in itself any idea of extension. We have seen that a set of retinal elements may be excited simultaneously, as well as serially; that so, a quasi single state of consciousness becomes the equivalent of a series of states; that a relation between what we call *coexistent positions* thus represents a relation of *successive positions;* that this symbolic relation being far briefer, is habitually thought of in place of that it symbolizes; and that, by the continued use of such symbols, and the union of them into more complex ones, are generated our ideas of visible extension—ideas which, like those of the algebraist working out an equation, are wholly unlike the ideas symbolized; and which yet, like his, occupy the mind to the entire exclusion of the ideas symbolized.

The fact however which it now more particularly behoves us to remember, is, that underlying all cognitions of visible extension, is the cognition of relative position among the states of consciousness accompanying motion.

§ 59. Leaving here the visual perception of body as presenting statical attributes, let us pass to the tactile perception of it—to such perception of Form, Size, and Position, as a blind man has. And before proceeding to deal with this perception in its totality, let us look at its components: considering these first as known to us; and then in our mode of knowing them.

It is an anciently established doctrine that Form or Figure, which we may call the most complex mode of extension, is resolvable into relative magnitude of parts. An equilateral triangle is one of which the three sides are alike in magnitude. An ellipse is a symmetrical closed curve, of which the transverse and conjugate diameters are one greater than the other. A

cube is a solid having all its surfaces of the same magnitude, and all its angles of the same magnitude. A cone is a solid, successive sections of which, made at right angles to the axis, are circles regularly decreasing in magnitude as we progress from base to apex. Any object described as narrow, is one whose breadth is of small magnitude when compared with its length. A symmetrical figure is a figure in which the homologous parts on opposite sides are equal in magnitude. Figures which we class as similar to each other, are such that the relation of magnitude between any two parts of the one, is equal to the relation of magnitude between the corresponding parts of the other. Add to which, that an alteration in the form of anything, is an alteration in the comparative sizes of some of its parts—a change in the relations of magnitude subsisting between them and the other parts; and that by continuously altering the relative magnitudes of its parts, any figure may be changed indefinitely. Hence, figure being wholly resolvable into relations of magnitude, we may go on to analyze that out of which these relations are formed—magnitude itself.

Though, in passing from a mode of extension which consists in relations of magnitude, and going on to consider magnitude itself, it would seem that relativity is no longer involved, this is not really the case. Of absolute magnitude we can know nothing. All magnitudes as known to us are thought of as equal to, greater than, or less than, certain other magnitudes—can be conceived in no other way. Not only is it that in speaking of a house as great, we mean, great in comparison with other houses; that in calling a man short, we mean, short in comparison with most men; and that in describing Mercury as small, and a certain pin's head as large, we mean, in comparison with planets and pins' heads respectively; but it is that no notion of magnitude can be formed, save one constructed out of the magnitudes given to us in experience, and therefore, thought of in relation to them. In what then consists the difference between figure and size as known to us? Simply in this: that whereas, in thinking of a thing's figure, we think

of the relations of magnitude which its constituent parts bear to each other; in thinking of its size, we think of the relation of magnitude which it, as a whole, bears to other wholes. Still however, there remains the question—What is a magnitude considered analytically? The reply is—It consists of one or more relations of position. When we conceive anything as having a certain bulk, we conceive its opposite limiting surfaces as more or less removed from each other; that is—as related in position. When we think of a particular area, we think of a surface whose boundary lines stand to each other in specific degrees of remoteness; that is—are related in position. When we imagine a line of definite length, we imagine its termini as occupying points in space having some positive distance from each other; that is as related in position. As a solid is decomposable into planes; a plane into lines; lines into points; and as adjacent points can neither be known nor conceived as distinct from each other, except as occupying different places in space—that is, as occupying not the same position, but relative positions—it follows that every cognition of magnitude, is a cognition of one or more relations of position, which are presented to consciousness as like or unlike one or more other relations of position.

This analysis of itself brings us to the remaining space-attribute of body—Position. Like Magnitude, Position cannot be known absolutely; but can be known only relatively. The notion of position, is, in itself, the notion of relative position. The position of a thing is inconceivable, save by thinking of that thing as at some distance from one or more other things. The essential elements of the idea will be best seen, on observing under what conditions only, it can come into existence. Imagine a solitary point A, in infinite space; and suppose it possible for that point to be known by a being having no locality. What now can be predicated respecting its place? Absolutely nothing. Imagine another point B, to be added. What can now be predicated respecting the two? Still nothing. The points having no attributes save

position, are not comparable in themselves; and nothing can be said of their relative position from lack of anything with which to compare it. The distance between them may be either infinite or infinitesimal, according to the measure used; and as, by the hypothesis, there exists no measure—as space contains nothing save these two points; the distance between them is unthinkable. But now imagine that a third point C, is added. Immediately it becomes possible to frame a proposition respecting their positions. The two distances A to B, and A to C, serve as measures to each other. The space between A and B may be compared with the space between A and C; and the relation of position in which A stands to B, becomes thinkable as like or unlike the relation in which A stands to C. Thus then, it is manifest that position is not an attribute of body in itself, but only in its connection with the other contents of the universe.

It remains to add, that relations of position are of two kinds: those which subsist between subject and object; and those which subsist between either different objects, or different parts of the same object. Of these the last are resolvable into the first. It needs but to remember, on the one hand, that in the dark a man can discover the relative positions of two objects only by touching first one and then the other, and so inferring their relative positions from his own position towards each; and on the other hand, that by vision no knowledge of their relative positions can be reached save through a perception of the distance of each from the eye; to see that ultimately, all relative positions may be decomposed into relative positions of subject and object.

These conclusions—that Figure is resolvable into relative magnitudes; that Magnitude is resolvable into relative positions; and that all relative positions may finally be reduced to positions of subject and object—will be fully confirmed on considering the process by which the space-attributes of body become known to a blind man. He puts out his hand, and touching something, thereby becomes cognizant of its position

with respect to himself. He puts out his other hand, and meeting no resistance above, or on one side of, the position already found, gains some negative knowledge of the thing's magnitude—a knowledge which three or four touches on different sides of it serve to render positive. And then, by continuing to move his hands over its surface, he acquires a notion of its figure. What, then, are the elements out of which, by synthesis, his perceptions of magnitude and figure are framed? He has received nothing but simultaneous and successive touches. Each touch established a relation of position between his centre of consciousness and the point touched. And all he can know respecting magnitude and figure—that is, respecting the relative positions of these points to each other—is necessarily known through the relative positions in which they severally stand to himself.

Our perceptions of all the space-attributes of body, being thus decomposable into perceptions of position like that gained by a single act of touch; we have next to inquire what is contained in a perception of this kind. A little thought will make it clear that to perceive the position of anything touched, is really to perceive the position of that part of the body in which the sensation of touch is located. Whence it follows that our knowledge of the positions of objects, is built upon our knowledge of the positions of our members towards each other—knowledge both of their fixed relations, and of those temporary relations they are placed in by every change of muscular adjustment. That this knowledge is gained by a mutual exploration of the parts—by a bringing of each in contact with the others—by a moving over each other in all possible ways; and that the motions involved in these explorations, are known by their reactions upon consciousness; are propositions that scarcely need stating. But it is manifestly impossible to carry the analysis further without analysing our perception of motion. Relative position and motion are two sides of the same experience. We can neither conceive motion without conceiving relative position, nor discover relative posi-

tion without motion. For the present, therefore, we must be content with the conclusion that, whether visual or tactual, the perception of every statical attribute of body is resolvable into perceptions of relative position which are gained through motion.

§ 60. Before defining in its totality, the perception of body as presenting statical attributes, it is necesssary to remark that the resisting positions which, as co-ordinated in thought, constitute our ideas of Figure or Magnitude, must be aggregated —must be continuous with an indefinite assemblage of intermediate resisting positions. If they are discontinuous—if they are separated by positions that do not resist, we have a perception not of one body, but of two or more.

Premising this, and omitting as doubly mediate our visual perceptions of extension in its several modes, we may say that the perception of body as presenting statical attributes, is a composite state of consciousness, having for its primary elements the indefinite impressions of resistance and extension, *unconditionally* united with each other and the subject in relations of coincidence in time and adjacency in space; and having for its secondary elements a series of relations between resisting positions, variously united with each other in relations of simultaneity and sequence that are severally *conditional* on the nature of the object and the acts of the subject, and all of them *conditionally* united with the primary elements by relations of sequence.

To which there is only to add, as before, that these being the *materials* of the perception, the *process* of perception consists in the unconscious classing of these impressions, relations, and conditions, with the like before-known ones.

CHAPTER XIII.

THE PERCEPTION OF SPACE.

§ 61. By implication something has been said in the last chapter, respecting our perception of Space. The consideration of occupied space cannot be dissociated from the consideration of unoccupied space. Body and Space being distinguished as resistant extension and non-resistant extension, it is impossible to treat of extension in any of its modes, without virtually treating of them both. Substantially, therefore, the inquiry on which we are now to enter, must be a continuation of the one just concluded. Before commencing it, however, there seems a need for some comments on the position of those who, holding that Space is a form of thought, consider all attempts to analyze our cognition of it as absurd.

Foremost among these, is Sir William Hamilton; who says that, "it is truly an idle problem to attempt imagining the steps by which we may be supposed to have acquired the notion of extension; when in fact we are unable to imagine to ourselves the possibility of that notion not being always in our possession."

Granting, for argument's sake, this alleged impossibility of conceiving ourselves ever to have been without the notion of extension, it does not necessarily follow either that extension is a form of thought, or that we are disabled from analyzing the notion we have of it. In a preceding criticism of the Kantian doctrine (§ 12), it was pointed out that our inability to banish from our minds the idea of space, was readily to be accounted for on the experience-hypothesis: seeing that if space be an universal form of the *non-ego*, it must produce some corresponding universal form in the *ego*—a form which,

as being the constant element of *all* impressions presented in experience, and therefore of *all* impressions represented in thought, is independent of every *particular* impression; and consequently remains when every particular impression is banished. And then, to the argument that whether extension is a form of thought or not, our inability to conceive ourselves as ever being without it, disables us from analyzing it, I reply, that though we may be disabled from analyzing it directly, we may still remain able to analyze it indirectly. Though, in any subjective examination of our mental processes, we may fail in finding any anterior elements of thought out of which to construct the idea; yet, by examining mental processes objectively, we may gain the means of conceiving how our own consciousness of space was originally constructed.

But what is here granted for argument's sake, may be denied. This alleged impossibility of conceiving ourselves ever to have been without the notion of extension, I, for one, do not admit. It appears to me quite possible for a man to think of himself as having possessed states of consciousness not involving any notion of extension; or, what is the same thing—it is quite possible to imagine trains of thought in which space is not implied. And indeed, it would be strange that the contrary should be asserted, were it not that we are so tyrannized over by the almost indissoluble associations which experience establishes, and so habitually carry them with us in all our thinkings, as to be constantly in danger of attributing to the undeveloped mind, ideas which only the developed mind possesses. It needs, however, but to figure ourselves as devoid of certain perceptions that are *known* to be acquired, and it at once becomes easy to conceive ourselves as having thoughts that do not imply space. Remembering that, as Sir William Hamilton expresses it, "we are never aware even of the existence of our organism, except as it is somehow affected;" let any one imagine a human being in that early stage in which he is yet unacquainted with his own body—in which he has had no experiences. It is admitted by Kantists that space

being but a *form* of thought cannot exist before thought—cannot be known in itself antecedently to experience; but that it is disclosed to consciousness in the act of receiving experiences. They assert that the matter of perception being given by the *non-ego,* and the form by the *ego,* the form and the matter come into consciousness simultaneously. In the supposed case, therefore, there is yet no idea of space. Let now the first impressions received, be those of sound. No one will allege that sound as an affection of consciousness, has any space-attributes. And even those who have little considered such questions, will admit that our knowledge of sound as coming from this or that point in space, is a knowledge gained by experience—is a knowledge quite separate from the sound itself—is a knowledge *inferred* from certain modifications of the sound; and that primarily the sound is known only as a pure undecomposable sensation. Further, let it be observed that the sensation of sound is of a kind that does not in itself make us "aware of the existence of our *organism,* as somehow affected." Only by experience do we learn that we hear through the ears. Aural impressions are so indistinctly localized, that, in spite of their associations, most adults even will perceive that were it not for their acquired knowledge, they would not know whereabouts on the surface of the body they were sentient. Hence, in the supposed state of nascent intelligence, sensations of sound, not having in themselves any space-attributes, and not in themselves disclosing any part of the organism as affected, would be nothing more than simple affections of consciousness, having no space implications; and would admit of being remembered and compared, without any idea of extension being involved. Having duly contemplated the case thus objectively presented, any one ordinarily endowed with imagination, will, I think, by closing his eyes, arranging his body so as to give as few disturbing sensations as possible, and banishing as much as he can all remembrance of surrounding things, be enabled to conceive the possibility of a state in which a varied series of sounds

known as severally like and unlike, and thought of solely in respect to their mutual relations, should be the entire contents of consciousness.

With such further reasons for holding that Space is not a form of thought, but a form of the *non-ego* disclosed to us by experience, we may be encouraged to continue that analysis of our perception of it collaterally entered upon in the last chapter.

§ 62. Starting afresh from the conclusions there reached—that, whether visual or tactual, every perception of the space-attributes of body is decomposable into perceptions of relative position; that all perceptions of relative position are decomposable into perceptions of the relative position of subject and object; and that these relations of position are knowable only through motion—the first question that arises is—How, through experiences of occupied extension, or body, can we ever gain the notion of unoccupied extension, or space? How, from the perception of a relation between resistant positions, do we progress to the perception of a relation between non-resistant positions? If all the space-attributes of body are resolvable into relations of position between subject and object, disclosed in the act of touch—if, originally, relative position is only thus knowable—if therefore position is, to the nascent intelligence, incognizable except as the position of something that produces an impression on the organism; how is it possible for the idea of position ever to be dissociated from that of body? how can the germinal notion of empty extension ever be gained?

This problem, though apparently difficult of solution, is really a very easy one. If, after some particular motion of a limb there invariably came a sensation of softness; after some other, one of roughness; after some other, one of hardness—or if, after those movements of the eye needed for some special act of vision, there always came a sensation of redness; after some others, a sensation of blueness; and so on—it is manifest that, in conformity with the known laws of association, there

would be established a constant relation between such motions and such sensations. If positions were conceived at all, they would be conceived as invariably occupied by things producing special impressions; and it would be impossible to dissociate the positions from the things. But as, in our experience, we find that a certain movement of the hand which once brought the finger in contact with something hot, now brings it in contact with something sharp, and now with nothing at all; and that a certain movement of the eye which once was followed by the sight of a black object, is now followed by the sight of a white object, and now by the sight of no object; it results that the idea of the particular position accompanying each one of these movements, is, by accumulated experiences, dissociated from objects and impressions, and comes to be conceived by itself; it results that as there are endless such movements, there come to be endless such positions conceived as existing apart from body; and it results that as in the first and in every subsequent act of perception, each position is known as coexistent with the subject, there arises a consciousness of endless such coexistent positions; that is—of Space. This is by no means offered as an ultimate analysis, or rather synthesis, of the idea; for, as before admitted, the difficulty is to account for our notion of relative position. All that is here attempted is, partially to explain, how, from that primitive notion may be derived the materials of which our cognition of Space in its totality is built.

Carrying with us this idea, and calling to mind the description given in the last chapter of the mode in which the retina is constructed, and the relations among its elements established, it will, I think, become possible to conceive how that wonderful perception which we have of visible space, is generated. It is a peculiarity of sight, as contrasted with all the other senses, that it makes us partially conscious of many things at once. On now raising my head, I take in at one glance, desk, papers, table, books, chairs, walls, carpet, windows, and sundry objects outside; all of them simultaneously

impressing me with various details of colour, which more or less tend to suggest surface and structure. It is true that I am not *equally* conscious of all these things at the same time. I find that some one object to which my eyes are directed, is more distinctly present to my mind than any other; and that the one point in this object on which the visual axes converge, is more vividly perceived than the rest. In fact, I have a perfect perception of scarcely more than an infinitesimal portion of the whole visual area. Nevertheless, I find that even while concentrating my attention on this infinitesimal portion, I am in some degree aware of the whole. My complete consciousness of a particular letter in the title on the back of a book at the other side of the room, does not seem to exclude a consciousness that there are accompanying letters—does not seem to exclude a consciousness of the book—does not even seem to exclude a consciousness of the table on which the book lies—nay, does not even seem entirely to exclude a consciousness of the wall against which the table stands. Of all these things I feel myself conscious in different degrees of intensity—degrees that become less, partly in proportion as the things are unobtrusive in colour and size, and partly in proportion as they recede from the centre of the visual field. Not that these various surrounding things occupy consciousness in the sense of being definitely known as such or such; for I find, on experiment, that while keeping my eyes fixed on one object, I cannot make that assertory judgment respecting any adjacent object which a real cognition of it implies, without becoming, for the moment, imperfectly conscious even of the object on which my eyes are fixed. But notwithstanding all this, it remains true that these various objects are in some sense present to my mind—are incipiently perceived—are severally tending to fill the consciousness—are each of them partially exciting the various mental states that would arise were it to be distinctly perceived.

This peculiarity in the faculty of sight—to which there is nothing analogous in the faculties of taste and smell; which,

in the faculty of hearing, is vaguely represented by our appreciation of harmony; and which is but very imperfectly paralleled in the tactile faculty by the ability we have to discern numerous irregularities in a rough surface on which the hand is laid—is clearly due to the structure of the retina. Consisting of an immense number of separate sensitive elements, each of them capable of independent stimulation, it results that when, as in any ordinary act of vision, a cluster of images is simultaneously cast on the retina, all of those numberless sensitive elements upon which the variously modified rays of light fall, are severally thrown into a state of greater or less excitement. Each of them, as it were, *touches* some particular part of one of the images; and conveys to the sensorium the feeling produced by the touch. But now, let it be remembered that, in the manner before explained, each retinal element has come to have a certain known relation to every one of those which surround it—a relation such that their synchronous excitation serves to represent their serial excitation. Lest this symbolism should not have been fully understood, I will endeavour yet further to elucidate it. Suppose a minute dot to be looked at—a dot so small that the image of it, cast upon the retina, covers only one of these sensitive elements, A. Now suppose the eye to be so slightly moved that the image of this dot falls upon the adjacent element B. What results? Two slight changes of consciousness: the one proceeding from the new retinal element affected; and the other from the muscles producing the motion. Let there be another motion, such as will transfer the image of the dot to the next element C. Two other changes of consciousness result. And so on continuously: the consequence being that the relative positions in consciousness of A and B, A and C, A and D, A and E, &c., are known by the number of intervening states. Imagine now that instead of these minute motions separately made, the eye is moved with ordinary rapidity; so that the image of the dot passes successively over the whole series A to Z, in an extremely brief space of time. What results? It is a familiar

fact that all impressions on the senses, and visual ones among the number, continue for a certain brief period after they are made. Hence, when the series of retinal elements A to Z, are excited in rapid succession, the excitation of Z commences before that of A has ceased; and for a short time the whole series A to Z remains in a state of excitement together. This being understood, suppose a line to be looked at whose image is long enough to cover the whole series A to Z. What results? There is a simultaneous excitation of the series A to Z, differing from the last in this; that it is continuous, and that it is unaccompanied by sensations of motion. But does it not follow from the known laws of mental suggestion, that as the simultaneous excitation is common to both cases, it will, in the last case, tend to arouse in consciousness that series of states that accompanied it in the first? Will it not as it were tend to *consolidate* the entire series of such states into one state? and will it not insensibly come to be taken as the equivalent of such series? There cannot I think be a doubt of it. And if not, then it becomes comprehensible how an excitement of consciousness by the coexistent positions constituting a line, serves as the representative of that serial excitement of it which accompanies motion along that line. Returning now to the above described state of the retina as occupied by a cluster of images—remembering that the relations of coexistent position which we have here considered in respect to a particular linear series, are similarly established throughout countless such series in all directions over the retina, so as to put each element in relation with every other—remembering further that in virtue of a process analogous to that described, the state of consciousness produced by the adjustment of the eyes to a particular focus has become a symbol of the series of coexistent positions between the eyes and the point to which they are directed—remembering all this, the genesis of our visual perception of space will begin to be vaguely comprehensible. Every one of the retinal elements simultaneously thrown into a state of partial excitement, producing as it does a partial consciousness not

only of itself as excited, but also of the many relations of coexistent position established between it and the rest, which are all of them similarly excited and similarly suggestive; there tends to arise a consciousness of a whole *area* of coexistent positions. Meanwhile the state of consciousness produced by the focal adjustment of the eyes, calling up as it does the line of coexistent positions lying between the subject and the object specially contemplated; and each of the things, and parts of things not in the centre of the field, producing, by the greater or less definiteness of its image, an incipient consciousness of its distance, that is, of the coexistent positions lying between the eye and it; there arises an indistinct consciousness of a whole *volume* of coexistent positions—of Space in three dimensions. Along with a *complete* consciousness of the one position to which the visual axes converge, arises a *nascent* consciousness of an infinity of other positions—a consciousness that is nascent in the same sense that our consciousness of the various objects out of the centre of the visual field is nascent. To all which it may be added, that as the innumerable relations subsisting between these coexistent positions were originally established by motion; as each of these relations of coexistent positions came by habit to stand for the series of mental states accompanying the motion which measured it; as every one of such relations must, when presented to consciousness, still tend to call up, in an indistinct way, that train of feelings, that sense of motion, which it represents; and as the simultaneous presentation of an infinity of such relations will tend to suggest an infinity of such experiences of motion, which, as being in all directions, must so neutralize each other as to prevent any particular motion being thought of; there will arise, as their common resultant, that sense of *ability to move*, that sense of *freedom for motion*, which forms the remaining constituent in our idea of Space.

Should any still find it difficult to conceive how, by so elaborate a process as the one described, there should be reached an idea apparently so simple, so homogeneous, as that which we have

of Space; they will perhaps feel the difficulty somewhat diminished on remembering:—first, that this process commences at birth; second, that every day throughout our lives, and throughout the whole of each day, we are, from moment to moment, repeating our experiences of these innumerable coexistences of position and their several equivalences to the serial states of feeling accompanying motions; and third, that these experiences invariably agree—that these relations of coexistent position are unchangeable—are ever the same towards each other and the subject—are ever equivalent to the same motions. By duly contemplating this early commencement of these experiences, this infinite repetition of them, and their absolute uniformity; and at the same time remembering the power which, in virtue of its structure, the eye possesses of partially suggesting to the mind countless such experiences at the same moment; it will become possible to conceive how we acquire that consolidated idea of space in its totality, which at first seems so inexplicable. And if, to develop somewhat further a late illustration, we call to mind the mode in which we regard long used symbols—how by habit each of the groups of letters now before the reader has acquired a seemingly inherent meaning—has ceased to be a mere series of straight and bent strokes, and has actually, as it were, *absorbed* some of the thought for which it stands; and if further we remember how, in our intellectual operations, these words have come to be the elements with which we think—how we cannot definitely realize to ourselves any proposition without putting it into words—and how the words are so habitually thought of to the exclusion of the things they signify, as to cause frequent mistakes; if we call to mind these facts, it will not be difficult to understand how, with symbols learnt much earlier, symbols incomparably more simple, uniform, and exact, symbols used every instant of our waking lives, a like transformation should have been carried much further. And this being understood, it may also be understood how the state of consciousness answering to any group of coexistent positions

made known by the senses, has supplanted in our minds the series of states of consciousness to which it was equivalent; and how, consequently, our space-perceptions have become a language in which we think of surrounding things, without at all thinking of those experiences of motion which this language expresses.

§ 63. Strong confirmations of this analysis may be drawn from certain peculiarities in our perception of space. If the reader whilst looking at his hand, or any equally close object, will consider what kind of knowledge he has of the space lying between it and his eyes, he will perceive that his knowledge of it is, as it were, exhaustive. He is conscious of the minutest differences of position in it. He has an extremely complete or detailed perception of it. If now he will direct his eyes to the farther side of the room, and contemplate an equal portion of that more remote space, he will find that he has but a comparatively vague cognition of it. He has nothing like so intimate an acquaintance with its constituent parts. If, again, he will look through the window, and observe what consciousness he has of a space that is a hundred yards away, he will discover it to be a still less specific consciousness. And on gazing at the distant horizon he will perceive that he has scarcely any perception of that far off space—has rather an indistinct *con*ception than a distinct *per*ception. This now is exactly the kind of knowledge that would result from the organized experiences above described. Of the space that is so close to us as to be within the range of our hands, we have the most complete perception, because we have had myriads of experiences of relative positions within that space. And of space as it recedes from us we have a less and less complete perception, because our experiences of the relative positions contained in it have been fewer and fewer.

The disordered feelings accompanying certain abnormal states of the nervous system, furnish similar evidence. De

Quincey, describing some of his opium-dreams, says that "buildings and landscapes were exhibited in proportions so vast as the bodily eye is not fitted to receive. *Space swelled,* and was amplified to an extent of unutterable infinity." It is not at all an uncommon thing with nervous subjects to have illusive perceptions in which the body seems enormously extended: even to the covering an acre of ground. Now the state in which these phenomena occur, is one of exalted nervous activity—a state in which De Quincey depicts himself as seeing in their minutest details the long-forgotten events of his childhood. And if we consider what effect must be produced upon the consciousness of space, by an excitement during which forgotten experiences are revived in extreme abundance and vividness, we shall see that it will cause the illusion of which he speaks. Of the myriad experiences of surrounding positions accumulated throughout life, we manifestly remember but a part. In common with all other experiences they severally tend to fade from the mind; and the perception of space would in the end become indistinct, were it not that they are day by day refreshed, or replaced by new ones. Imagine now, that these innumerable experiences of relative positions, which have been hourly registered in the mind from infancy upwards, and of which the earliest are quite effaced, while intermediate ones continue in various degrees of faintness—imagine these innumerable fading experiences suddenly to revive, and become definitely present to consciousness. What must result? It must result that space will be known in comparatively microscopic detail. Within any portion of space ordinarily thought of as containing a certain quantity of positions, an immensely greater quantity of positions will be thought of. Between the eye and each point looked at, whose distance is commonly conceived as equivalent to a certain series of positions, a far more extensive series will be conceived; and as the length of each such series is the mind's measure of the distance, all distances will appear increased, all

points will appear more remote, and it will seem that space has "swelled," as De Quincey expresses it.

Yet another fact having the same implication, is supplied by that striking change in our cognition of space which results during a temporary inability to see. Any one guided into a totally dark place with which he is unacquainted, and of which there are consequently no recollected visual impressions to occupy his imagination, will find that he almost loses his ordinary idea of space—that he almost ceases to be conscious of it as an infinity of coexistent positions, and remains conscious of it only as permitting freedom of movement. Even on merely closing the eyes for a few minutes, and, as far as may be, excluding from the mind all recollection of adjacent objects, it will be perceived that distant space cannot be thought of at all, except by remembering the cognition of it gained through the eyes; and that the space near at hand, is presented to the mind more as a negation of resistance than anything else. Most persons on several times repeating this experiment, and critically observing their ideas, will, I think, find, that could they move their limbs without imagining the visible changes accompanying the motions, this negation of resistance would be almost their sole cognition of space; and that until, after the manner of the blind, they had developed their tactual experiences of positions, they would be unable to think of space as they at present think of it. Now these are just the mental conditions to which the foregoing analysis points. The infinity of coexistent positions suggested by any visual impression, having become by habit the language in which we think of space, to the exclusion of those motor experiences which this language represents; it results that in proportion as we are deprived of this language, are we disabled from thinking of space: just as we should be almost incapacitated for reasoning, by the loss of our words.

And here let it be further observed, that while these several phenomena perfectly conform to the experience-hypothesis,

they are irreconcilable with the antagonist one. The fact that our idea of adjacent space differs in completeness from our idea of remote space, is wholly at variance with the hypothesis that space is a form of thought; which implies a perfect homogeneity in our idea of space. That in morbid states of the brain, space should appear "swelled," is, on the Kantian theory, unaccountable: seeing that the *form* of thought should remain constant, whether the thought itself be normal or abnormal. And similarly inconsistent with his theory, is the change in our cognition of space caused by a temporary privation of vision; which, if space were a subjective condition, would cause no change.

§ 64. Leaving here the inquiry into our perception of space in its totality, a few further words are called for respecting that relation of two coexistent positions, in our consciousness of which, the problem ultimately centres. From time to time in the progress of the argument, something has been done towards explaining the nature of this consciousness—towards showing that it is a state of consciousness serving to symbolize a series of states to which it is found equivalent. But, as before said, it is desirable to postpone the more definite analysis of this perception of coexistent positions, until the perception of motion is dealt with. At present the only reason for recurring to it, is to point out the indissoluble union between the cognition of space and the cognition of coexistence; and afterwards what is implied by this.

Not only is it that the idea of space involves the idea of coexistence; but it is that the idea of coexistence involves the idea of space. Fundamentally, space and coexistence are two sides of the same cognition. On the one hand space cannot be thought of without coexistent positions being thought of: on the other hand coexistence cannot be thought of without at least two points in space being thought of. A relation of coexistence implies two somethings that coexist. Two somethings cannot occupy absolutely the same point in space.

And hence coexistence implies space. If it be said that one body can have coexistent attributes, and that therefore two attributes can coexist in the same place; the reply is, that body itself is unthinkable except as presenting coexistent positions—a top and a bottom, a right and a left. Body cannot be so diminished, even in imagination, as to present only one position; or, in other words—in ceasing to present in thought more than one position, it ceases to be body. And as attributes imply body—as a mere position in space can have no other attribute than that of position, it follows that a relation of coexistence, even between attributes, is inconceivable without an accompanying conception of space. Space can be known only as presenting relations of coexistence: relations of coexistence can be known only as presented in space.

If now it should turn out under an ultimate analysis, that a relation of coexistence is not directly cognizable, but is cognizable only by a duplex act of thought—only by a comparison of experiences; the question between the transcendentalists and their opponents will be set finally at rest. When, after it has been shown, as above, that our cognition of space in its totality is explicable upon the experience-hypothesis, and that all the peculiarities of the cognition confirm that hypothesis, it comes to be shown that the ultimate element into which that cognition is decomposable—the relation of coexistence—can itself be gained only by experience; the utter untenableness of the Kantian doctrine will become manifest. That this will be so shown, the reader must at present take for granted. I am obliged thus to forestall the argument, because it would be inconvenient, during an analysis of the several orders of relations, to recur at any length to the controversy respecting space.

§ 65. To complete the chapter it needs but to say, that the process of organic classification, shown in previous cases to constitute the act of perception, is very clearly exhibited in the perception of space. The materials of the perception hav-

ing been gained in the way described, the co-ordination of them into any particular perception, consists in the assimilation of each relation of position to the like before-known relations. In every glance we cast around, the distinct consciousness of the distance of each thing specially looked at, and the nascent consciousness of the distances of various neighbouring things, alike imply a classing of present distances with remembered distances. These distances being one and all unknowable under any other condition, there is no alternative but to admit this. And the seemingly incomprehensible fact that numberless such classings should be simultaneously made by us without attracting our attention, simply shows to what perfection the process of automatic classification is brought by infinite repetition.

CHAPTER XIV.

THE PERCEPTION OF TIME.

§ 66. The near relationship between our notion of Time and our notion of Space, is implied in various current forms of speech. In the phrase—"a space of time," a magnitude of one is expressly used to signify a magnitude of the other. Conversely, the Swiss tourist whose inquiries respecting distances are answered in *stunden*, or hours; and the savage who, in common with the ancient Hebrew, has a place described to him as so many days' journey off; find times used to express spaces. The like reciprocity of symbolism is visible in science. Not only is it that a second of time is a function of the length of the pendulum, and that our hours are measured by spaces on the dial; but it is that, in astronomy, a degree, which was originally a day's journey of the sun along the ecliptic, has become the name of an angular space.

Joined to the arguments contained in the last chapter, these facts will be seen to possess considerable significance. *That in early ages, and in uncivilised countries, men should have expressed space in terms of time, and that afterwards, as a result of progress, they should have come to express time in terms of space;* is a circumstance giving strong support to the views recently developed: not only because it shows conclusively that the phenomena of coexistence, and those of sequence, *are* made to stand for each other in the mind; but because it shows, repeated, as it were, on a higher platform, that gradual supplanting of mental sequences by their equivalent coexistences, lately described as the process by which our cognition of space is acquired. Just as the series of states of consciousness accompanying any motion—a series which at first formed the sole representative of space—was

described as becoming consolidated into a quasi single consciousness of the coexistent positions traversed during that motion, which single consciousness afterwards expresses to the mind the series it was equivalent to; so, that series of states of consciousness implied by "a day's journey"—a series which, in early ages, formed the only definite representative of a great space—is seen to have become, in process of time, consolidated into a consciousness of the coexistent positions traversed (measured by miles or leagues); and this practically single state of consciousness has, more or less, supplanted in thought and word the series of states represented by it. And if any one, wishing yet further illustration of this process of mental substitution, will observe to what an extent he has acquired the habit of thinking of the spaces on the clock-face instead of the periods they stand for—how, on suddenly discovering it to be half an hour later than he supposed, he does not distinctly realize the half-hour in its duration, but scarcely passes beyond the sign of it as marked by the finger; he will be enabled still more clearly to conceive that the use of coexistences to symbolize sequences, which in these complex cases has become so habitual, has in the simplest cases become organic.

This reciprocity between our cognitions of Space and Time, alike in their primitive and most developed forms, being perceived; and the consequent impossibility of considering either of them entirely alone, being understood; let us go on to deal more particularly with Time.

§ 67. As the ideas of Space and Coexistence are inseparable, so also are the ideas of Time and Sequence. It is impossible to think of Time without thinking of some succession: and it is equally impossible to think of any succession without thinking of Time. Time, like Space, cannot be conceived except by the establishment of a relation between at least two elements of consciousness: the difference being, that while, in the case of Space, these two elements are, or seem

to be, present together, in the case of Time they are not present together.

The doctrine that Time is knowable to us only by the succession of our mental states, is so old and well established a one as to call for little exposition. All that seems necessary, is, so far to modify the statement of it as will bring out its harmony with the foregoing doctrines. And to this end, it will be well first to call to mind a few facts illustrating the entirely relative character of the cognition.

Every one remembers that in childhood, when, from the novelty of surrounding things and events, the number of vivid impressions made in a given period was much greater than in after life, time seemed to go much more slowly. The observation is common, that a week spent in travelling or sight-seeing, and therefore unusually full of mental excitements, appears in retrospect far longer than one spent at home; and that, similarly, a road followed for the first time, apparently takes longer to traverse than when it has become familiar. The phenomena accompanying morbid conditions of the brain, supply analogous illustrations. Describing the worst stage of his opium-dreams, when "the sea appeared paved with innumerable faces, imploring, wrathful, despairing, surging upwards by thousands, by myriads, by generations, by centuries"—when architectural imagery, presented with insufferable vividness and splendour, had a "power of endless growth and self-reproduction" — when, therefore, the mental impressions were immensely numerous and extremely distinct, De Quincey says, that he sometimes seemed "to have lived for 70 or 100 years in one night;" nay, to have had "feelings representative of a millennium passed in that time, or, however, of a duration far beyond the limits of any human experience." Even persons in health occasionally have, in the course of a doze lasting but a few minutes, dreams that appear to occupy considerable periods. And yet still more significant is the fact, to which there are many testimonies, that a sleeper suddenly awakened by a loud noise, may be able to recount some

dream to which a loud noise was the expected termination, and which was evidently heard, but which was suggested by the noise, yet be one seeming to have extended over hours or days.

From all which it is manifest, that our notion of any period of time, is wholly determined by the length of the series of remembered states of consciousness that have occurred during that time. I say *remembered* states of consciousness, because, as any series of states of consciousness can be known only by memory; and as any of the states that have occurred, but are not represented in memory, cannot become members of the series; it results that the series of remembered states can alone serve as the measure between a past and a present state. And hence the explanation of all such facts as that any interval looked back upon by a child, appears longer than the same interval looked back upon by an adult: seeing, that out of the same series of domestic and other experiences, many which are novel to the child, and therefore make a deep impression upon it, are so familiar to the adult as to make scarcely any impression at all. And the length of the series of remembered states of consciousness being thus our measure of time, we have no longer any difficulty in understanding cases in which vivid ideas, following each other with extreme rapidity, cause a night to seem like a hundred years, or, as in some drowning persons, a few minutes to represent a whole life.

When, however, we say that the time between two events is recognized by the series of remembered states of consciousness intervening, what do we more specifically mean? These two events are known to us by the states of consciousness they produce. Before the first of them there were countless other states of consciousness: since the last of them there have been others: and between them there were others. We know them, therefore, as having certain *places* in the whole series of states of consciousness experienced during our lives. The time at which each occurred is known to us as its *position* in the series. And by the time between them, we mean their *relative positions* in the

series. As any relation of coexistent positions—any portion of space, is conceived by us as such or such, according to the number of other positions that intervene; so, any relation of sequent positions—any portion of time, is conceived by us as such or such, according to the number of other positions that intervene. Thus, a particular time, is a relation of position between some two states in the series of states of consciousness. And, in the abstract, Time, as known to us, is, *relativity of position among the states of consciousness.*

§ 68. From this analysis it will perhaps be inferred, that whether Space be, or be not, a form of thought, Time must necessarily be one. As there can be no thought without a succession of states of consciousness; and as there can be no succession of states of consciousness except in Time; Time must be a condition of thought, or a form of thought. This, however, is not what the Kantian hypothesis means. It is not simply alleged that thought is possible only in Space and in Time: this no one questions. But it is alleged that the cognitions of Space and Time are necessary *constituents* in all other cognitions—that they are disclosed to consciousness *along with* the concrete elements of every idea—that notions of Time and Space of the same nature as the adult possesses, are simultaneous with the first perceptions—are the all-essential framework of them—are the forms of them. This is the sense in which the transcendental doctrine is understood; and it may be shown from the foregoing analysis that in this sense it is not true.

It is, doubtless, to be concluded, either from what has been said above, or from other data, that even in the first stages of intelligence, successive states of consciousness must be severally recognized as standing to each other in certain relations of position—as either occurring next to each other, or as separated by one or more intervening states. Though at first, probably no considerable portion of the series of states can be contemplated at once, and no *distant* members of it brought

into relation, yet the simplest cognition implies that sundry of the *proximate* members of it are co-ordinated in thought, and their respective places therefore known. But neither the contemplation of any two states of consciousness that stand in certain relative positions, nor the thinking of their relation of position as like some other relation of position, gives, in itself, the notion of time: although it is the raw material out of which that notion is constructed. Time, as conceived by us, is not any one relation of position in the series; nor any relation between two such relations; but is the abstract of all such relations—is the idea of *relationship* of position in the series: and cannot possibly be conceived until a great number of individual relations have been known and compared. To elucidate this, let us consider a parallel case. Suppose an incipient intelligence to receive two equal impressions of the colour red. No other experiences having been received, the *relation* between these two impressions cannot be thought of in any way: seeing that there exists no other relation with which it can be classed, or from which it can be distinguished. Suppose two other equal impressions of red to be received. There can still exist no idea of the relation between them: seeing, that though there is a repetition of the previously experienced relation, yet, since no thing can be cognized save as of some kind; and as, by its very nature, kind implies the establishment of difference; there cannot, while only one order of relation has been experienced, be any cognition of it—any thought about it. Suppose, now, that two unequal impressions of red are received. There is now experienced a second species of relation. And if there are afterwards presented a number of such pairs of impressions, that are severally equal and unequal, it becomes possible for the constituents of each new pair to be vaguely thought of as like or unlike, and as standing in relations like or unlike previous ones. I say vaguely thought of, because, while various impressions of the colour red are the sole things known, the cognition of them as like or unlike, will not be distinctly separable from the

impressions themselves. When, however, other series of impressions come to be received—as of the colour green in different intensities—the occurrence among these also of some that are like, and of others that are unlike, will tend to dissociate these relations from the colours green and red. And gradually as, by the accumulation of experiences, there are found to be like and unlike sounds, tastes, smells, sizes, forms, textures; the relationships which we signify by these words like and unlike, will be more and more dissociated from particular impressions; and the abstract ideas *likeness* and *unlikeness* will come into existence. Manifestly, then, the ideas of likeness and unlikeness are impossible until after multitudes of things have been thought of as like and unlike. Similarly in the case before us. After various relations of position among the states of consciousness have been contemplated, have been compared, have become familiar; and after the experiences of different relations of position have been so accumulated as to dissociate the idea of the relation from all particular positions; then, and not till then, can there arise the abstract notion of *relativity of position* among the states of consciousness—the notion of Time.

Thus, so far is it from being true that Time, as conceived by us, is a form of thought; it turns out, contrariwise, not only that there *can* be thoughts while yet Time has not been conceived, but that there *must* be thoughts before it can become conceivable.

§ 69. The necessary dependence of Time upon Motion is a doctrine taught by Aristotle, who asks—"How can time be when motion is not?" and who argues that, "if time is a numeration of motion, and if time be eternal, motion must be eternal."

Whether or not the objective relation between Time and Motion be, as is here asserted, indissoluble; it is beyond question that, subjectively, the two cannot be separated. Motion, as understood by the developed mind, is inconceivable without

an accompanying conception of Time; and Time can be disclosed to us only through Motion. Though, when once we have accumulated a stock of ideas that can follow one another through consciousness even when the senses are in repose, we can recognize Time apart from any perceived motion; yet, it needs but to consider that all these ideas were gained through motion—that had neither we nor surrounding things ever moved, we should have had no ideas at all, and therefore no conception of Time—to see clearly that Time is knowable only through motion. As, according to the foregoing analysis, our notion of Time is the notion of relativity of position in the series of states of consciousness; as this presupposes a series of such states; as this presupposes successive changes of state; it follows that that which is required to produce changes of state, is that through which Time is disclosed. And it needs but a little reflection to see, that without motion, subjective or objective, no changes of consciousness could ever have been generated.

Respecting the perception of any particular portion of time (or *con*ception it might perhaps more strictly be called; seeing that the majority of its constituents are represented, rather than presented, to consciousness) it only needs saying that it consists in the classing of the relation of position contemplated, with certain before-known relations—the cognition of it as like such before-known relations.

CHAPTER XV.

THE PERCEPTION OF MOTION.

§ 70. Our ideas of Motion, Time, and Space, are so intimately connected, that it is extremely difficult to disentangle them. On the one hand, preceding chapters have shown that Space and Time are knowable only through Motion: on the other hand, it is by some contended, with great apparent truth, that Motion is unknowable except as in Space and Time; and that, therefore, notions of Space and Time must pre-exist. Taking which two positions together, there would really seem no course left but to adopt the Kantian hypothesis; and conclude that Time and Space are forms of sensibility, that are disclosed to consciousness in the act by which Motion is perceived. A closer consideration, however, will show that there is an alternative.

For though Motion, as known by the developed mind, cannot be conceived without accompanying conceptions of Space and Time; it does not therefore follow that Motion, as known by the *un*developed mind, cannot be conceived without such accompaniments. It does not follow that because the connection between the ideas is, in adult life, indissoluble, it was always so. The whole confusion has arisen from the totally unwarrantable assumption, that certain impressions received through the senses, were originally understood in a way just like that in which they are understood after the accumulation of an infinity of experiences—an assumption at variance with the established facts of Psychology. Do we not know that the daily rising and setting of the sun, are thought of in completely different ways by the clown and by the astronomer? Do we not know that the adult and the juvenile

differ widely in the conceptions suggested to them by the action of a lever, a pulley, or a screw? Do we not know that the form of a house is comprehended by the child, after a manner in which the infant cannot comprehend it? Moreover, is it not admitted that much of our acquired knowledge becomes so consolidated as to disable us from dissociating its elements in our minds—that on grasping an apple we cannot, without great difficulty, so confine our consciousness to the sensations of touch, as to avoid thinking of the apple as spherical—that we find it utterly impossible, when looking at a neighbouring object, to shut out all thought of the distance, and attend only to the visual sensations? And when we unite these two general facts—first, that by the putting together of experiences the mind acquires conceptions quite different from those it originally had; and, second, that experiences which have been from the beginning invariably connected, and perpetually connected, become fused into conceptions that are undecomposable by any subjective contemplation of them—does it not become manifest, both that the adult's idea of Motion is entirely distinct in nature from the infant's idea of Motion, and that it has become impossible for the adult to think of Motion as the infant thought of it? The candid inquirer cannot doubt it. And not doubting it, he will see the vice of the assumption that what are necessities of thought to us, are therefore necessities of thought in the abstract. He will see that the phenomena must be dealt with, not by subjective analysis, but must be analyzed objectively—must be considered, not as they present themselves to our consciousness, but as they would present themselves to a consciousness unoccupied by foregone conclusions.

"But how," it may be asked, "is it possible for us thus to deal with the phenomena? How can we legitimately speak of Motion as known in some form different from that in which we know it? How can we treat of a conception which we cannot ourselves have?" Very readily. For though in our adult consciousness of Motion, the ideas of Space and Time are inextricably involved; yet there is another element in that

consciousness which we can very clearly perceive would remain, were the ideas of Space and Time absent. Though it is perfectly true that on moving my arm, even when in the dark, I cannot become conscious of the motion without being simultaneously conscious of a space traversed and a time occupied in traversing it; yet I find that the muscular sensations accompanying the motion, are altogether distinct in nature from the ideas of Space and Time associated with them. I find no difficulty in so far isolating these sensations in thought, as to perceive that the consciousness of them would remain were my ideas of Space and Time abolished. And I find no difficulty in conceiving that Motion is thinkable by the infant as consisting of these sensations, while yet the notions of Space and Time are undeveloped. Seeing then that Space and Time are knowable only through Motion; and seeing that the primitive consciousness of Motion may readily be conceived to have contained but one of the elements ultimately included in it; we are warranted in the inquiry whether, out of such a primitive consciousness of Motion, the consciousness we have of it may be evolved.

§ 71. To open this inquiry systematically, let us first look at the several data furnished by preceding chapters.

We saw that our conception of Space is a conception of the relativity of coexistent positions; that the germinal element of the conception is the relation between two coexistent positions; that every relation between two coexistent positions is resolvable into a relation of coexistent positions between the subject and an object touched; that this relation of coexistent positions between subject and object, is equivalent to the relation of coexistent positions between two parts of the body; and that thus the question—How do we come by our cognition of Space? is reducible to the question—How do we discover the relation of coexistent positions between two sentient points on our surface?

Our conception of Time we saw to be that of relativity of sequent positions—relativity of position in the series of the states of consciousness. We saw that the germinal element out of which

this conception is developed, is a relation of position between two states of consciousness; and that every relation of position between two states of consciousness is known by the number of remembered intervening states.

Respecting Motion, we know that as, through it only are changes in consciousness originally produced, through it only can relations of sequent positions among states of consciousness be disclosed; and that for the same reason, through it only can be disclosed the relations of coexistent positions. At the same time we know that whether Motion is or is not originally cognizable in any other way, it is from the beginning cognizable through the changes of consciousness it produces. If it be subjective motion, as that of a limb, it is present to the mind as a continuous but varying series of sensations of muscular tension. If it be objective motion, as that of something traversing the surface of the body, or as that of something passing before the eyes, it is still present to the mind as a continuous series of sensations: in the one case the tactual sensations that result from touching a succession of points on the skin; in the other case the visual sensations that result from exciting a succession of points on the retina. And if the motion be both subjective and objective, as when one part of the body is drawn over another part, or when a limb is extended within view of the eyes, then it is present to the mind as a double series of sensations: in the one case, as a series of muscular sensations joined with a simultaneous series of tactual sensations; in the other case, as a series of muscular sensations joined with a simultaneous series of visual sensations. Finally, when the hand is moved over the body within view of the eyes, motion is present to the mind as a triple series of sensations—muscular, tactual, visual—occurring simultaneously.

Omitting for the present all consideration of the visual phenomena, let us now turn our attention to the question in which centres the whole controversy respecting the genesis of our ideas of Motion, Space, and Time: the question namely—How do we become cognizant of the relative positions of two

points on the surface of the body? Such two points considered as coexistent, involve the germinal idea of Space. Such two points disclosed to consciousness by two successive tactual sensations proceeding from them, involve the germinal idea of Time. And the series of muscular sensations by which, when self-produced, these two tactual sensations are separated, involve the germinal idea of Motion. The questions to be considered then, are—In what order do these germinal ideas arise? and—How are they developed?

Already, in treating of visible extension (§ 58), and the visual perception of space (§ 62), and in showing how serial states of consciousness are consolidated into simultaneous states which become their equivalents in thought, the way has been prepared for answering these questions. The process of analysis partially applied to retinal impressions, has now to be applied, after a more complete manner, to impressions on the body at large. To this end, taking for our subject a newly-born infant, let us call the two points on its body between which a relation is to be established, A and Z. Let us assume these points to be anywhere within reach of the hands—say upon the cheek. By the hypothesis, nothing is at present known of these points; either as coexisting in Space, as giving successive sensations in Time, or as being brought into relation by Motion. If now, the infant moves its arm in such a way as to touch nothing, there is a certain vague reaction upon its consciousness—a sensation of muscular tension. This sensation has the peculiarity of being indefinite in its commencement; indefinite in its termination; and indefinite in all its intermediate changes. Its strength is proportionate to the degree of muscular contraction. Whence it follows that as the limb starts from a state of rest, in which there is no contraction; and as it can reach a position requiring extreme contraction only by passing through positions requiring intermediate degrees of contraction; and as the degree of contraction must therefore form a series ascending by infinitesimal increments from zero; the sensations of tension must also form

such a series. And the like must be the case with all subsequent movements and their accompanying sensations; seeing that, be it at rest or in action, a muscle cannot pass from any one state to any other without going through all the intermediate states. Thus, then, the infant, on moving its arm backwards and forwards without touching anything, is brought to what we may distinguish as a nascent consciousness—a consciousness not definitely divisible into states; but a consciousness the variations of which pass insensibly into each other, like undulations of greater or less magnitude. And while the states of consciousness are thus incipient—thus indistinctly separated, there can be no clear comparison of them; no classing of them; no thought, properly so called; and consequently, no ideas of Motion, Time, or Space, as we understand them. Suppose, now, that the hand touches something. A sudden change in consciousness is produced—a change that is incisive in its commencement, and, when the hand is removed, equally incisive in its termination. In the midst of the continuous feeling of muscular tension, vaguely rising and falling in intensity, there all at once occurs a distinct feeling of another kind. This feeling, beginning and ending abruptly, constitutes a definite state of consciousness; and becomes, as it were, a *mark* in consciousness. By similar experiences other such marks are produced; and in proportion as they are multiplied, there arises a possibility of comparing them, both in respect to their degrees and their relative psitions: while at the same time, the feelings of muscular tension being, as it were, divided out into lengths by these superposed marks, become similarly comparable; and so there are acquired materials for a simple order of thought. Observe, also, that while these tactual sensations may, when several things are touched in succession, produce successive marks in consciousness, separated by intervening muscular sensations, they may also become continually coexistent with these muscular sensations; as when the finger is drawn along a surface. And observe further, that when the surface over which the finger is

drawn is not a foreign body, but some part of the subject's body, these muscular sensations, and the continuous tactual sensation joined with them, are accompanied by a series of tactual sensations proceeding from that part of the skin over which the finger is drawn. Thus, then, when the infant moves its finger along the surface of its body from A to Z, there are simultaneously impressed upon consciousness three sets of sensations —the varying series of sensations proceeding from the muscles in action; the series of tactual sensations proceeding from the points of the skin successively touched between A and Z; and the continuous sensation of touch from the finger-end. Now it might be argued that some progress is made towards the idea of space, in the simultaneous reception of these sensations—in the contemplation of them as coexistent: seeing that the notion of coexistence and the notion of space have a common root; or in other words—seeing that to be conscious of a duality or multiplicity of sensations, is the first step towards being conscious of that duality or multiplicity of points in space which they imply. It might also be argued that as, when the finger is moved back from Z to A, these serial sensations are experienced in a reverse order, there is thus achieved a further step in the genesis of the idea: seeing that coexistent things are alone capable of impressing consciousness in any order with equal vividness. But passing over these points, let us go on to notice, that as subsequent motions of the finger over the surface from A to Z, always result in the like simultaneous sets of sensations, these, in course of time, become indissolubly associated. Though the series of tactual sensations, A to Z, being producible by a foreign body moving over the same surface, can be dissociated from the others; and though, if the cheek be withdrawn by a movement of the head, the same motion of the hand, with its accompanying muscular sensations, may occur without any sensation of touch; yet, when these two series are linked by the tactual sensation proceeding from the finger-end, they necessarily proceed together; and become inseparably con-

nected in thought. Whence, it obviously results that the series of tactual sensations A to Z, and the series of muscular sensations which invariably accompanies it when self-produced, serve as mutual equivalents; and being two sides of the same experience, suggest each other in consciousness. Due attention having been paid to this fact, let us go on to consider what must happen when something touches, at the same moment, the entire surface between A and Z. This surface is supplied by a series of independent nerve-fibres, each of which at its peripheral termination becomes fused into, or continuous with, the surrounding tissue; each of which is affected by impressions falling within a specific area of the skin; and each of which produces a separate state of consciousness. When the finger is drawn along this surface, these nerve-fibres A, B, C, D, . . . Z, are excited in succession; that is—produce successive states of consciousness. And when something covers, at the same moment, the whole surface between A and Z, they are excited simultaneously; and produce what tends to become a single state of consciousness. Already I have endeavoured to show in a parallel case (§ 58), how, when impressions first known as having sequent positions in consciousness are afterwards simultaneously presented to consciousness, the sequent positions are transformed into coexistent positions, which, when consolidated by frequent presentation, are used in thought as equivalent to the sequent positions: and it is needless here to repeat the explanation. What it now concerns us to notice is this:—*that as the series of tactual impressions* A *to* Z, *known as having sequent positions in consciousness, are, on the one hand, found to be equivalent to the accompanying series of muscular impressions; and on the other hand, to the simultaneous tactual impressions* A *to* Z, *which, as presented together are necessarily presented in coexistent positions; it follows that these two last are found to be the equivalents of each other.* A series of muscular sensations becomes known as equivalent to a series of coexistent positions; and being habitually joined with it, becomes at last unthinkable without it. Thus, the relation of coexistent positions between the points A and Z

(and by implication all intermediate points), is necessarily disclosed by a comparison of experiences: the ideas of Space, Time, and Motion, are evolved together. When the successive states of consciousness A to Z, are thought of as having relative positions, the notion of Time becomes nascent. When these states of consciousness, instead of occurring serially, occur simultaneously, their relative positions, which were before sequent, necessarily become coexistent; and there arises a nascent consciousness of Space. And when these two relations of coexistent and sequent positions are both presented to consciousness along with a series of sensations of muscular tension, a nascent idea of Motion results.

The development of these nascent ideas, arising as it does from a still further accumulation and comparison of experiences, will be readily understood. What has been above described as taking place with respect to one relation of coexistent positions upon the surface of the skin—or rather, one linear series of such coexistent positions, is, during the same period, taking place, with respect to endless other such linear series, in all directions over the body. The like equivalence between a series of coexistent impressions of touch, a series of successive impressions of touch, and series of successive muscular impressions, is being established between every pair of points that can readily be brought into relation by movement of the hands. Let us glance at the chief consequences that must ultimately arise from this organization of experiences.

Not only must there gradually be established a connection in thought between each *particular* muscular series, and the *particular* tactual series, both successive and simultaneous, with which it is associated; and not only must there, by implication, arise a knowledge of the special muscular adjustments required to touch each special part; but, by the same experiences, there must be established an indissoluble connection between muscular series in general and series of sequent and coexistent positions in general: seeing that this connection is repeated in every one of the particular experiences. And when we consider the infinite repetition of these experiences, we shall

have no difficulty in understanding how their components become so consolidated, that even when the hand is moved through empty space, it is impossible to become conscious of the muscular sensations, without becoming conscious of the sequent and coexistent positions—the Time and Space, in which it has moved.

Observe again, that as, by this continuous exploration of the surface of the body, each point is put in relation not only with points in some directions around it, but with points in all directions—becomes, as it were, a centre from which radiate lines of points known first in their serial positions before consciousness, and afterwards in their coexistent positions—it follows, that when an object of some size, as the hand, is placed upon the skin, the impressions from all parts of the area covered being simultaneously presented to consciousness, are placed in coexistent positions before consciousness: whence results an idea of the superficial extension of that part of the body. The idea of this extension is really nothing more than a simultaneous presentation of all the impressions proceeding from the various points it includes, which have previously had their several relative positions measured by means of the series of impressions separating them. Any one who hesitates respecting this conclusion, will, I think, adopt it, on critically considering the perception he has when placing his open hand against his cheek—on observing that the perception is by no means single, but is made up of many elements which he cannot think of all together—on observing that there is always one particular part of the whole surface touched, of which he is more distinctly conscious than of any other—and on observing that to become distinctly conscious of any other part, he has to traverse in thought the intervening parts; that is, he has to think of the relative positions of these parts by vaguely recalling the series of states of consciousness which a motion over the skin from one to the other would involve.

It is needless now to dwell upon that further development of these fundamental ideas which results when the visual experi-

ences are united with the tactual and muscular ones. Being merely a further complication of the same process, it may readily be traced out by joining with the above explanations, those given when treating of visible extension and space. It will suffice here to say that, by serving clearly to establish in our minds the identity of subjective and objective motion, sight finally enables us more or less completely to dissociate Motion in the abstract, from those muscular sensations through which it is primarily known to us; and that by doing this, and by so reducing our idea of Motion to that of coexistent positions in Space occupied in successive positions in Time, it produces the apparently necessary connection between these three ideas.

§ 72. Thus then, we find that Motion, originally present to consciousness under a far simpler form than that in which we know it, serves by its union with tactual experiences to disclose Time and Space to us; and that, in the act of disclosing them, it itself becomes clothed with the ideas of them; and ultimately becomes inconceivable without these ideas.

It remains to add that the perception of Motion, as we know it, consists in the establishment in consciousness of a relation of simultaneity between two relations—a relation of coexistent positions in Space, and a relation of sequent positions in Time. In other words, the consciousness of Motion is produced by a simultaneous presentation of these relations—a united cognition of them. And it is scarcely needful to say that in the act of perception, these jointly-presented relations are severally assimilated to the like relations before known—that the perception of great velocity, for example, is possible only by simultaneously thinking of two coexistent positions as *remote*, and two sequent positions as *near*: which words remote and near, imply the classing of the two relations with previously experienced ones. And similarly with perceptions of the kind of motion, and the direction of motion.

CHAPTER XVI.

THE PERCEPTION OF RESISTANCE.

§ 73. We may conclude, *à priori*, that of the various impressions received by consciousness, there must be some most general impression. The building up of our experiences into a complex structure, implies a fundamental experience on which the structure may rest. The great mass of our sensations, and of the perceptions we form out of them, being merely signs, there must be something which they are signs of; and this something, whatever be its special modifications, must have an essential element. By successive decompositions of our knowledge into simpler and simpler components, we must come at last to the simplest—to the ultimate material—to the substratum. What is this substratum? It is the impression of resistance. This is the primordial, the universal, the ever-present constituent of consciousness.

It is primordial, alike in the sense that it is an impression of which the lowest orders of living beings show themselves susceptible, and in the sense that it is the first species of impression received by the infant—alike in the sense that it is appreciated by the nerveless tissue of the zoophyte, and in the sense that it is presented in a vague manner, even to the nascent consciousness of the unborn child.

It is universal, both as being cognizable (using that word not in the human but in a wider sense) by every creature possessing any sensitiveness, and usually as being cognizable by all parts of the body of each—both as being common to all sensitive organisms, and in most cases as being common to their entire surfaces.

It is ever present, inasmuch as every creature, or at any rate every terrestrial creature, is subject to it during the whole of its existence. Excluding those lowest animals which make

no visible response to external stimuli, and those which float passively suspended in the water, there are none but what have, at every moment of their lives, some impressions of resistance; proceeding either from the surfaces on which they rest, or the reaction of their members during locomotion, or both.

Thus, impressions of resistance, as being the earliest that are appreciated by the sensitive creation regarded as a progressive whole, and by every higher creature in the course of its evolutions; and as being appreciated by almost all parts of the body in the great majority of creatures; are necessarily the first materials put together in the genesis of intelligence. And as being the impressions continuously present in one form or other throughout life, they necessarily constitute that thread of consciousness on which all other impressions are strung—form, as it were, the weft of that tissue of thought which we are ever weaving.

But leaving general statements, let us go on to consider these truths somewhat in detail.

§ 74. That our perception of Body has for its ultimate elements impressions of resistance, is a conclusion to which all the foregoing analyses point. In the order of thought (and of any other order we can know nothing) resistance is the primary attribute of body; and extension is a secondary attribute. We know extension only through a combination of resistances: we know resistance immediately by itself. All space-attributes of body are unknowable save by synthesis; while this primordial attribute is knowable without synthesis. Again, a thing cannot be thought of as occupying space, except as offering resistance. Even though but a point in space, if it be conceived to offer absolutely *no* resistance, it ceases to be anything—becomes *no*-thing. Resistance is that by which occupied extension (body) and empty extension (space) are differentiated. And the primary property of body, considered as a different thing from not-body, must be that by which it is universally

distinguished from not-body: namely resistance. Moreover, it is by resistance we determine whether any appearance is body or not. Resistance without appearance, we decide to be body; as when striking against any object in the dark. Appearance without resistance, we decide not to be body; as in the case of optical illusions. Once more there is a thing which we know to be body *only* by its resistance; namely, air. We should be ignorant that there was such a thing as air, were it not for its resistance. And we endow it with extension by an act of pure inference. Thus, not only is it that body is primarily known as resistant, and that subsequently, through a combination of resistances, it is known as occupying space, but it is that there is one kind of body which presents to our senses no other attribute than that of resistance.

That our cognition of Space can arise only through an interpretation of resistances, is an obvious corollary from preceding chapters. As was shown, the ultimate element into which our notion of Space is resolvable, is that of the relation between two coexistent positions. And that such two coexistent positions may be presented to our consciousness, it is necessary that they should be occupied by something capable of impressing our organism; that is—by something resistant. As admitted on all hands, Space, in itself, having no sensible properties, would be for ever unknowable to us did it not contain objects. Even Kantists do not contend that it is knowable by itself; but say that our experiences of things are the *occasions* of its presentation to us. And as all our experiences of things are ultimately resolvable into experiences of resistance—are all either resistances or the signs of resistances; it follows that on any hypothesis, Space is cognizable only through experience of resistances.

Similarly with Motion. As was shown in the last chapter, subjective motion is primarily known to us as a varying series of states of muscular tension; that is—sensations of resistance. The series of tactual sensations through which it is otherwise known, are sensations produced by something that

resists. And when, ultimately, objective motion comes to be recognized by sight, it is recognized as a phenomenon equivalent to those previously known through the muscular and visual sensations conjoined; as when we move our own limbs within view of the eyes. So that, abstracting all the elements we afterwards add to it, motion is originally the generalization of a certain order of resistances.

Our notion of Force, also, has a parallel genesis. It is not simply that in science and the arts, resistance, as ascribed by us to objects, is used to measure motive force, and is therefore conceived by us as an equivalent force; but it is that resistance, as known subjectively in our sensations of muscular tension, forms the substance of our conception of force. That we have such a conception, is a fact that no metaphysical quibbling can set aside. That we must necessarily think of force in terms of our experience—must construct our conception of it out of the sensations we have received, is also beyond question. That we have never had, and never can have, any experience of the force by which objects produce changes in other objects, but that we can never immediately know these changes as anything more than antecedent and consequent phenomena, is equally indisputable. And that therefore, our notion of force is a generalization of those muscular sensations which we have when we are ourselves the producers of change in outward things, is an unavoidable corollary. How we are necessarily led to ascribe force, as thus conceived, to all external workers of change, is readily shown. We find that the same sensible effects are produced when body strikes against us, as when we strike against body. Hence we are obliged to represent to ourselves the action of body upon us as like our action upon it. And the sensible antecedent of our action upon body being the feeling of muscular tension, we cannot conceive its action upon us as of like nature, without vaguely thinking of this muscular tension, that is, of force, as the antecedent of its action.

Thus, Matter, Space, Motion, Force—all our fundamental

ideas, arise by generalization and abstraction from our experiences of resistance. Nor shall we see in this anything strange, if we do but contemplate, under its simplest aspect, the relation between the organism and its environment. Here is a subject placed in the midst of objects. It can learn nothing of them without being affected by them. Being affected by them implies some action produced by them upon its surface. Their action must be either action by direct contact, or by the contact of something emanating from them. In virtue of the law of gravitation, their primary and most continuous action is by direct contact. In the nature of things, also, their all-important actions, both destructive and preservative—through enemies and through food—are by direct contact. Hence, action by direct contact, being the primary action, the ever-present action, the all-important action, and at the same time the simplest and most definite action, becomes the action of which all other kinds of action are representative. And the sensation of resistance, through which this fundamental action is known, becomes, as it were, the mother-tongue of thought, in which all the first cognitions are registered, and into which all symbols afterwards learnt are interpretable.

§ 75. The matter will be further elucidated, and this last position especially confirmed, on observing that all the sensations through which the external world becomes known to us, are explicable by us only as resulting from certain forms of force. As already shown (§ 50) the so-called secondary attributes of body are dynamical. Science determines them to be the manifestations of certain energies possessed by matter; and even when not scientifically analyzed, they are spoken of as implying the actions of things upon us. But we cannot think of the actions of things upon us, except by ascribing to them powers or forces. These powers or forces must be presented to our minds in terms of our experience. And, as above shown, our only experience of force is the muscular tension which we feel when overcoming force: this constitutes our conscious-

ness of force, and our measure of force. Hence, not only is it that our experiences of resistance form the elementary material of thought, alike as being earliest, as being ever present, and as underlying our fundamental ideas; not only is it that our other experiences are employed by us as the representatives of these elementary experiences; but it is that we cannot understand these other experiences except by translating them into terms derived from the elementary experiences.

An extremely important fact to be here noticed, as further illustrating the same truth, is, that resistance, as disclosed to us by opposition to our own energies, is the only species of external activity which we are obliged to think of as subjectively and objectively the same. *We are disabled from conceiving mechanical force in itself, as differing from mechanical force as presented to our consciousness.* The axiom—"Action and reaction are equal, and in opposite directions," applied as it is not only to the action of objects upon each other, but to our action upon them and their action upon us, implies a conception of the two forces as equivalent, both in quantity and nature; seeing that we cannot conceive a relation of equality between magnitudes that are not connatural. How happens it, then, that in this case alone we are compelled to think of the objective force as like the force which we feel? Sound, we can very well conceive as consisting in itself of vibrations, having no likeness whatever to the sensation they produce in us. The impressions we have of colour, can, without much difficulty, be understood as purely subjective effects resulting from an objective activity to which they have not even a distant analogy. And similarly with the phenomena of heat, smell, and taste. Why, then, can we not represent to ourselves the force with which a body resists our efforts to move it, as a something quite unlike the feeling of muscular tension which its resistance gives us? There is an all-sufficient reason. It is not simply that whether we strike or are struck, the sound, the indentation, the sensations of touch, pressure, and pain, are of the same kind; nor is it that we can make the force which is known to our conscious-

ness as muscular tension, produce an effect like that produced by an external body—as when, taking one of the weights out of a pair of scales in equilibrium, we raise the antagonist weight by pressing down the empty scale with the hand; nor is it that we can store up our own force in objects, and make them afterwards expend it in producing results such as it would have directly produced—as when we strain a bow and let its recoil propel the arrow; but it is that *there exists no alternative mode of representing this force to consciousness*—no other experience, or combination of experiences, by which we can figure it to our minds. Saying nothing of the various facts which, like those just instanced, strengthen the idea of sameness between muscular effort in the subject and mechanical power in the object; our inability to conceive this mechanical power as being in itself different from what we feel it to be in our muscular efforts, is primarily due to the circumstance that there is no feeling, no impression, no mode of consciousness, which we can substitute for this primordial mode. The liberty which we have to think of light, heat, sound, &c., as in themselves different from our sensations of them, arises solely from this; that we possess other sensations by which to symbolize them—namely, those of mechanical force: and it needs but to glance at any theory of objective light, heat, sound, &c., to see that we *do* think of them in terms of mechanical force; that is, in terms of our muscular sensations. But if we attempt to think of mechanical force as in itself different from our impression of it, there arises the insurmountable difficulty that there is no remaining species of impression to represent it. All other experiences being expressed to the mind in terms of this experience, this experience cannot be expressed to the mind in any terms but its own. To be conceived at all, mechanical force must be represented in some state of consciousness. This state of consciousness must be one directly or indirectly resulting from the action of things upon us. The states of consciousness produced by all other actions than mechanical action, we already represent to our minds in states such as those produced by

mechanical action. There remains, therefore, no available state of consciousness save that produced by mechanical action. And hence it is impossible for us to represent mechanical action to ourselves, in any other state of consciousness than that which it produces in us—it is impossible for us to think of objective force as different from our subjective experience of it. Though the proposition that they *do* differ is verbally intelligible, it is absolutely inconceivable, and must ever remain so.

§ 76. Having thus seen that the perception of resistance is fundamental, alike in respect of genesis, in respect of universality, and in respect of continuity; and that as a consequence it is also fundamental in the sense of being the perception into which all other perceptions are interpretable, while itself interpretable into none; we may proceed to consider it analytically.

As shown when treating of the statico-dynamical attributes of body, the sensations concerned in our various perceptions of resistance, are those of touch proper, pressure, and muscular tension, either uniform or changing. The sensation of touch proper cannot be considered as in itself giving an immediate knowledge of resistance; but is simply the sign of something capable of resisting. When the contact is so gentle as to produce no feeling of pressure, it cannot be said whether the object is soft or hard, large or small. It is simply inferred that there is something: just as it would have been had a sensation of sound or colour been received. Hence the sensation of touch proper may be left out of the inquiry.

Our knowledge of resistance, then, is gained through the sensations of pressure and muscular tension. These may occur separately. When our bodies are inactive, save in the sense of being gravitative and resistant masses of matter, we have the sensation of pressure only—either from the reaction of the surface on which we rest; or from the action of a weight placed upon us; or from both. When, as a consequence of some volition, we bring our forces to bear upon outward objects—

when our bodies are active and objects are reactive—we have coexistent sensations of pressure and muscular tension. And when, as on raising the arm into a horizontal position, the bodily action is such as to call forth no direct reaction from objects, we experience the sensation of muscular tension alone. Now the fact to be here more particularly noticed, is, that whenever the sensations of pressure and muscular tension coexist, they always, other things equal, vary together. Now that I am holding my pen gently between the fore-finger and thumb, I have a very slight sensation of pressure and a very slight sensation of muscular tension. If I grasp the pen hard, both sensations increase in intensity; and I find that I cannot change one without changing the other. The like relation is observable on raising light and heavy weights; or on thrusting against small and large objects. Hence it results that these sensations become known to consciousness as equivalents. A given sensation of pressure, is thinkable as tantamount to a certain sensation of muscular tension; and *vice versâ*. And now there arises the inquiry—which of these two is habitually used in thought as the sign, and which as the thing signified?

In point of time the two are co-ordinate. Not only from the very first, does the infant experience the reaction upon consciousness accompanying the action of its own muscles; but from the very first, it has sensations of pressure from the surfaces on which it rests, and from the hands that lay hold of it. But though equally early, and as it would seem, equally fundamental, it may be readily proved that in the order of constructive thought, the sensation of muscular tension is primary, and that of pressure secondary. This will be made tolerably manifest by the simple consideration, that these sensations of pressure caused by the weight of the body and the actions of the nurse, can at first give no notions of what we understand as resistance or force; seeing that before they can give such notions, there must exist ideas of weight and of objective action. Originally these sensations of pressure which the infant

passively receives, being unconnected in experience with definite antecedents and consequents, are as isolated and meaningless as sensations of sound or odour. Not to dwell upon this fact however, further than to point out that the *involuntarily-produced* sensations of pressure may be left out of the question, let us, in the first place, go on to observe that the *voluntarily-produced* sensations of pressure are second in order of time to the sensations of muscular tension. Before the infant can experience the feelings which neighbouring objects give to its moving limbs and fingers, it must first experience the feelings that accompany the motion of its limbs and fingers. In the second place let it be observed, that the muscular sensations are more general than the voluntarily-produced sensations of pressure; seeing that while these last occur only when the energies are employed upon external bodies, the first occur *both* when the energies are thus employed, and when they are employed in moving and holding up the limbs themselves. Let it be observed in the third place, that while only *some* of the sensations of pressure are voluntarily produced, *all* the sensations of muscular tension are voluntarily produced. And let it once more be observed, that when both are voluntarily-produced—as when some object is grasped, or lifted, or thrust against—the muscular sensation is always present to consciousness as the antecedent, and the sensation of pressure as the consequent; and that any variation in the last, is known as resulting from a variation in the first. Among the intelligible experiences of the infant, therefore, the sensation of muscular tension, being alike the earliest, the most general, and that which stands in the position of immediate antecedent to the sensation of pressure, whenever the origin of that sensation is known, is necessarily the sensation in which all experiences of resistance are registered and thought of. Hence the reason why, when anything pushes against us, we do not represent its force to our minds in terms of the pressure experienced; but in terms of the effort which that pressure signifies. Hence the fact that when the

weight of an object is spoken of, we do not think of the intensity of the tactile impression which results on lifting it; but of the intensity of the accompanying muscular strain.

That the cognition of resistance is finally resolvable into that of muscular tension, and that this forms the raw material of thought in its earliest forms, will be most clearly seen on considering that at first it forms the only available measure of external phenomena. The acquisition of knowledge is from the beginning experimental. Were the infant to remain passive in the midst of surrounding objects, it could never arrive at a comprehension of them. It can arrive at a comprehension of them, only by active exploration. But what is the condition under which alone such an exploration will answer its end? How can the properties of things be compared, and estimated, and classified? By means of some *common measure* already possessed. The infant's only mode of determining the amounts of external activities, is, by ascertaining how much of its own activity they are severally equivalent to. As inanimate objects cannot act upon it in such way as to disclose their properties, it must call out their reactions by acting upon them: and to become cognizant of these reactions, implies some scale of action in itself. This scale of action must underlie the whole structure of its experiences—must be the substratum of its thoughts—must be that mode of consciousness to which all other modes are ultimately reducible. Thus then, the sense of muscular tension, of which this scale is constituted, forms, in the nature of things, the primitive element in our intelligence.

§ 77. Respecting the perception of resistance, that is of muscular tension, it has still to be pointed out that it consists in the establishment of a relation of coexistence between the muscular sensation itself and that particular state of consciousness which we call *will*. That the muscular sensation alone, does not constitute a perception of resistance, will be seen on remembering that we receive from a tired muscle, a feeling nearly allied to, if not identical with, that which we receive

from a muscle in action; and that yet this feeling, being unconnected with any act of volition, does not give any notion of resistance.

To which there is only to add, that in the act of perception, this relation is classed with the like foreknown relations; and that in so classing it, consists the knowledge of the special muscular combination, adjustment, and degree of force exercised.

CHAPTER XVII.

PERCEPTION IN GENERAL.

§ 78. As foregoing chapters have made sufficiently manifest, the term Perception, is commonly applied to states of consciousness infinitely varied, and even widely different in nature. Between the consciousness of a vast landscape, and the consciousness of a minute dot on the surface of this paper, there exist countless gradations which pass insensibly one into another; and which yet unite extremes almost too strongly contrasted to be classed together. A perception may vary indefinitely in complexity, in degree of directness, and in degree of continuity. As in one of the primitive cognitions of resistance lately treated of, it may rise but a step above simple sensation. On the other hand, when watching the evolutions of a ballet, there is a consciousness not only of the multiplied relations of coexistent positions which constitute our notions of the distance, size, figure, and attitude of each dancer—not only of the various like relations between each and the several colours of her dress—not only of the relations of position among the respective dancers; but also, of the numerous relations of sequence which the body and limbs of every dancer exhibit in their movements with respect to each other; and of those yet more involved relations of sequence exhibited in the movements of every dancer with respect to the rest. In degree of directness, again, there is a similarly marked contrast between the perception that some surface touched by the finger is hard, and the perception that a building under whose walls we stand is a particular cathedral. The one piece of knowledge is almost immediate: the other is mediate in a double, a triple, a quadruple, and even in a still higher degree—mediate inasmuch as the solidity of the building is inferential; inasmuch as its

proximity is inferential; inasmuch as its position, its size, its shape, are inferential; inasmuch as its artificial origin, its material, its hollowness, are inferential; inasmuch as its ecclesiastical purpose is an inference from these inferences; and inasmuch as the identification of it as a particular cathedral, is yet a still more remote inference resulting from the union of these inferences with those various others through which the locality is recognised. In like antithesis stand the degrees of continuity, in our respective perceptions of an electric spark, and the rush of a cataract which attracts our gaze. And when to these various facts, we add the further fact, that our perceptions, or at any rate our visual perceptions, are continuous in Space as well as in Time—that when looking at a landscape and turning our eyes to different parts of it, we cannot say how much is contained in each perception, or how many perceptions take in the panorama—that while only one particular point in the whole field of view is perceived with perfect distinctness, innumerable other points are perceived with degrees of distinctness imperceptibly decreasing as they recede from the central point, so that it is impossible to say where the perception ends—when we remember this, it will be abundantly manifest that the state of consciousness which we call a perception, cannot be rigorously marked out and separated; but that it merges insensibly into others of its own kind, both synchronous and successive, and into others which we class as of different kinds, both superior and inferior. It passes at the one extreme into reasoning; and at the other borders upon sensation. It may include innumerable relations simultaneously co-ordinated; or but a single relation. It cannot be demarcated from the nascent perceptions that coexist with it; nor (where the thing perceived is in motion) from the perceptions which follow it. So that, however convenient a term Perception may be for common purposes, it must not be understood as signifying any truly scientific division.

§ 79. The only valid distinction to be drawn, is that between

Perception and Sensation. Though from time to time referred to with more or less distinctness by early philosophers, it is only in later times that this distinction has been currently acknowledged; and it is but recently that the relation between the two has been specifically formulated in the doctrine of Sir William Hamilton, "that, above a certain point, the stronger the Sensation, the weaker the Perception; and the distincter the perception the less obtrusive the sensation; in other words —though Perception proper and Sensation proper exist only as they coexist, in the degree or intensity of their existence they are always found in an inverse ratio to each other." Before making any criticisms upon this doctrine, which seems to me rather an adumbration of the truth than the truth itself, it will be needful to state the exact meanings of Sensation proper and Perception proper.

Manifestly, every sensation, to be known as such, must be perceived—must become an object of perception; and hence, as thus considered, all sensations are perceptions. The mere physical affection of the organism does not constitute a sensation proper. While absorbed in thought, I may be subject to undue heat from the fire, uncomfortable pressure from a hard seat, or a continual noise from the street; and though my sentient organs are very decidedly affected, I may yet remain unconscious of the affections—may become conscious of them only when they pass a certain degree of intensity; and only then can be said to experience them as sensations. Moreover, not only in sensation proper, do I contemplate the organic affection as an affection of myself—as a state of consciousness standing in a certain relation to other states; but I also contemplate it as existing in a certain part of my body—as standing in certain relations of position. I perceive *where* it is. But though, under both these aspects, sensation must be regarded as one species of perception, it will readily be seen to differ widely from perception proper—from the cognition of an external object. In the one case, that which occupies consciousness is something contemplated as belonging to the *ego*: in the other, it is something contemplated as belonging to the *non-*

ego. And these it is, which, as sensation proper and perception proper, are asserted to coexist in degrees of intensity that vary inversely.

That this is not altogether a correct assertion, will, I think, become apparent on carefully examining the facts as determined by experiment. Let the finger be brought against some hard rough body—say a broken stone, the back of a ribbed sea-shell, or anything capable of giving a tactile impression of some complexity. Between that degree of pressure used in ordinary touch, and the pressure that is painful from its intensity, there are many gradations; and Sir William Hamilton's doctrine implies that, beginning with the degree of pressure needful for distinct perception, and gradually increasing it until the pain becomes unbearable, the perception, step by step decreases in vividness, while the sensation, step by step increases in vividness; but that neither at the beginning nor the end, does the one exclude the other. Do the facts correspond with this statement? I think not. During the ordinary gentle pressure, it will be found that consciousness is occupied entirely about the surface and its irregularities; that no thought is taken of the sensations through which the surface and its irregularities are known; that to attend to these sensations rather than to the objective phenomenon implied by them, requires a decided effort; and that when they are thought of, it is in another state of consciousness quite distinct from the previous one. If the pressure be gradually increased, there is not a gradual decrease in the vividness of the perception and an increase in the vividness of the sensation, but the consciousness remains, as before, occupied about the surface; the hardness and roughness of which, become the peculiarities most contemplated as the pressure becomes greater: and though the sensation may be more easily thought of than before, and is more distinctly realized when it is thought of, still, it can be thought of only in a second state of consciousness not included in the original one. But now, if the pressure be increased so far as to produce decided pain, there will occur quite a different state of consciousness, in which the thing con-

templated is the subjective affection and not its objective cause. When the pain reaches any considerable intensity, it will be found that the perception has not only altogether ceased, but that it can be recalled into consciousness only by an effort. And it will be very clearly perceived that were the nature of the object producing the painful pressure, not already known, it would be entirely unknowable. Generalizing the facts then, it would seem, not so much that Sensation and Perception vary inversely, as that they exclude each other with varying degrees of stringency. When the sensations (considered simply as physical changes in the organism) are weak, the objective phenomenon signified by them is alone contemplated: the sensations are altogether excluded from consciousness, and cannot be brought into it without a decided effort. When the sensations are rendered somewhat more intense, the perception still remains equally vivid—still remains the sole occupant of consciousness; but as, by their increasing intensity, the sensations tend to force themselves into consciousness, it requires less effort than before to make them the subject of thought. Gradually as the intensity of the sensations is further increased, a point is approached at which consciousness is as likely to be occupied by them, as by the external fact they imply—a point at which either can be thought of with equal facility, and at which each tends in the greatest degree to draw attention from the other. If the intensity of the sensations be yet further increased, they begin to occupy consciousness to the exclusion of the perception, which, however, can still be brought into consciousness by a slight effort. But, finally, if the sensations rise to extreme intensity, consciousness becomes so absorbed by them, that it is impossible without great effort, if at all, to think of the thing causing them.*

* Those who wish to test this statement experimentally, should remember that the mere act of observing the *current* phenomena of consciousness, itself introduces a new element into consciousness, which tends more or less to disturb the processes going on. The observations should be made obliquely rather than directly—should if possible be made, not *during*, but *immediately after*, the appropriate experiences.

What now is the real nature of this mutual exclusion? Is it not an instance of the general fact that consciousness cannot be in two distinct states at the same time? I cannot know that I have a sensation, without, for the moment, having my attention occupied solely with that sensation: I cannot know the external thing causing it, without, for the moment, having my attention occupied solely with that external thing: and as either cognition rises, the other ceases. If, as Sir William Hamilton asserts, the two cognitions always coexist, though in inverse intensities, then it must happen, that if, beginning at either extreme, the conditions be slowly changed, so that while the cognition most distinctly present to the mind becomes gradually less distinct, the other becomes gradually more distinct; there must arrive a time when they will be equally distinct—when the subjective and objective phenomena will be thought of together with equal clearness; which is impossible. It is very true, as shown above, that under such change of conditions, there arrives a time when the subjective and objective phenomena attract the attention in equal degrees, and are thought of *alternately* with equal facility. And it may even be admitted that while either is being thought of, the other is nascent in thought. But this is quite a different thing from saying that they occupy consciousness together.

Perception proper and sensation proper, will however be best understood, and the purpose of the present chapter most furthered, by considering their antagonism under the light of preceding analyses. In all cases it has been found that perception is an establishment of specific relations among states of consciousness; and is so distinguished from the establishment of the primary states of consciousness themselves. While in apprehending a sensation, the mind is occupied with a single subjective affection; in apprehending the external something producing it, the mind is occupied with the relation or relations between that affection and others, either past or present. The sensation cannot be known save as an undecomposable state of consciousness. The outward object cannot be known save as

a decomposable state of consciousness; which is recognized as such or such, in virtue of the special manner in which the component states are united. Now the contemplation on the one hand of a special state of consciousness, and on the other of the special relations among states of consciousness, are quite different mental acts—acts which may be performed in immediate succession, but not together. To know a relation is not simply to know the terms between which it subsists. Though when the relation is perceived, the terms are nascently perceived, and conversely, yet introspection will show that there is a distinct transition in thought from the terms to the relation, and from the relation to the terms. That the whole matter centres in the question—How do we think of a relation as distinguished from the terms between which it subsists? will be plain from the fact that Sir William Hamilton, while implying that it is something more, himself says that in one respect, "perception proper is an apprehension of the relations of sensations to each other." Joining which doctrine with the one contended against, we see that, according to his hypothesis, the sensations and the relations between them, can be simultaneously thought of with equal degrees of distinctness, or with any other relative degrees of distinctness—a manifestly untenable proposition.

The only further remark here called for, is, that perception cannot be correctly defined as "an apprehension of the relations of *sensations* to each other"; for that in most perceptions some of the elements are not presented but represented in consciousness. When passing the finger over a rough surface, the perception contains very much more than the co-ordinated sensations immediately experienced. Besides these it contains the remembered visual impressions produced by such a surface; which cannot be kept out of the mind; and in the suggestion of which the perception largely consists. Again, when gazing at some one object, it will be found that objects on the outskirts of the field of view, are recognized more by representation than by presentation. If, without moving his eyes, the

observer asks himself what he actually perceives of these outlying objects, he will find that they impress him simply as ill-defined patches of colour; that were it not for his previous experiences, he would not know the meanings of these patches; and that in perceiving what the objects are, he eks out the vaguely presented impressions with some comparatively distinct represented ones. And what thus manifestly happens with perceptions of this order, happens in one form or other with all perceptions. In fact, when analyzed to the bottom, all perceptions prove to be acquired perceptions. From its simplest to its most complex forms, perception is essentially a diagnosis.

§ 80. Finally, to express in its most general form the truth that has been variously illustrated in detail—Perception is a discerning of the relation or relations between states of consciousness, partly presentative and partly representative; which states of consciousness are themselves known only to the extent involved in the knowledge of their relations.

Under its simplest form—a form however of which the adult mind has few if any examples—perception is the consciousness of a single relation. More commonly, a number of relations are simultaneously presented and represented; and the relations between these relations are cognized. Most frequently, the relations of relations of relations are the objects of perception: as when any neighbouring solid body is regarded. And very often—as when observing the motions of an animal, which are known to us as the relations between certain highly complex relations of position now present, and certain others just past—a still more abstract relativity is contemplated.

Further it is to be noticed, that in the ascending grades of perception, there is an increase not only in the number and abstractness of the relations grasped together, but also in the variety of their kinds. Numerous relations of position, of extension, of coexistence, of sequence, of degree in all sensible

qualities, are co-ordinated in one thought; or what appears to us such.

Add to which that, as heretofore pointed out in each special case, the act of perception is the establishment of a relation of likeness between the particular relation or group of relations contemplated, and some past relations or groups of relations—the assimilation of it to such past relations or groups of relations—the classing of it with them.

§ 81. And now it remains only to apply the analysis thus far pursued, to the relations themselves. By a continued process of decomposition we have found that our intellectual operations severally consist in the establishment of relations, and groups of relations, among the primitive undecomposable states of consciousness, produced in us by our own actions and the actions of surrounding things. But what are these relations? They can be nothing more than certain secondary states of consciousness, produced by the union of the primary states. Unable as we are to transcend consciousness, we can know a relation only as some modification of consciousness. The original modifications of consciousness are the feelings produced in us by subjective and objective activities; and any further modifications of consciousness must be such as result from combinations of these original ones. In all their various kinds and compounds, what we call relations, can be to us nothing more than the modes in which we are affected by the comparison of sensations, or remembered sensations, or both. Hence what we have next to do, is, first to resolve the special kinds of relations into the more general kinds; and then to ascertain what are the ultimate phenomena of consciousness which the primordial relations express.

CHAPTER XVIII.

THE RELATIONS OF SIMILARITY AND DISSIMILARITY.

§ 82. Of all relations the most complex is that of Similarity—that in virtue of which we range together objects of the same species, notwithstanding their differences of magnitude; and in virtue of which we put into the same class, phenomena of causation that are widely contrasted in degree. Already, in treating of Reasoning and of Classification, much has been said of this relation which forms their common basis. Here it needs only to state what it is when considered under its most general aspect.

The similarity which we predicate of natural objects belonging to the same class, is made up of many component similarities. Two animals identical in kind but unlike in size, are similar not only as wholes, but are also similar in their parts. The head of one is similar to the head of the other; the leg to the leg; the hoof to the hoof; the eye to the eye. Even the parts of the parts will be found more or less similar; as, on comparing two teeth, the crown to the crown, and the fangs to the fangs. And even such minute components as the hairs, show in their structure this same parallelism. One of these ordinary similarities therefore, consisting of an intricate plexus of similarities held together in similar ways, and resolvable as it consequently is into simple similarities, will, by implication, be analyzed in analyzing one of these simple similarities.

Though similarities of sequence do not admit of a complication parallel to that which similarities of coexistence admit of —seeing that, as known by us, a sequence is in its nature single—yet, they admit of another species of complication: namely, that arising from composition of causes and composition of effects. While, by the gravitation of a weight, the

string to which it hangs may be elongated, and no other appreciable result be produced; by the joint action of a certain temperature, a certain amount of moisture, and a certain miasm, upon an individual of a particular diathesis, who happens to be in a particular state, there may be produced the immense complication of effects constituting a disease. Each of these sequences is classed with others which we call similar; and in conjunction with them may form a premiss for future conclusions. And though, in the first case, there is a single antecedent and a single consequent, while, in the second case, there is a group of antecedents and a group of consequents—though in this second case the antecedent is not a force, but a variety of forces united in a special plexus of relations, and the consequent is not an effect, but a variety of effects united in a special plexus of relations; yet, we so obviously think of a composite cause and a composite effect, as related in the same way that a simple cause and a simple effect are related, that in treating of similar sequences we may confine our attention to the simple ones, as those out of which the others arise by complication of the terms.

Thus, then, choosing some primitive type of each, we have to consider what there is in common between similar coexistences and similar sequences.

§ 83. Of the one class, similar triangles furnish the most convenient example: and as an example of the other, we may take the uniform sequence of heat upon compression.

After all that was before said, it is needless to do more than remind the reader, that in both of these cases the similarity resolves itself into either equality or likeness of relations—that triangles are similar when any two sides of the one bear to each other a relation like that which the homologous sides of the other bear to each other; and that when classing as similar, the various cases in which compression produces heat, the likeness of the relations between compression and heat in those various cases, is the sole thing meant. Here it concerns us, not to dwell

upon the fact that similarity is likeness of relations, but to consider what this likeness of relations implies.

In the first place, it is to be observed, that while it implies likeness in nature between the two antecedents and between the two consequents, it does not imply likeness in their amounts; but that, in nearly all cases, though not necessarily, the two antecedents are quantitatively unlike, and the two consequents are quantitatively unlike. Two triangles may be similar, though the sides of the one are severally a score times as great as the homologous sides of the other; and though in one case a small evolution of heat results from the pressure of a hundred pounds, and in another case a greater evolution from the pressure of a hundred tons, the cases are classed as similar. So that thus regarded, similarity may be described as the likeness of relations whose antecedents are like in kind, but mostly unlike in degree, and whose consequents are like in kind, but mostly unlike in degree.

This likeness of relations has itself two phases. It may be both qualitative and quantitative; or it may be qualitative only. It may be a likeness both in the kind of the relations and their degree; or it may be a likeness in kind only. And hence arise the two orders of similarity—perfect and imperfect: the similarity on which mathematical reasoning proceeds; and the similarity on which the reasoning of daily life proceeds. Thus, in the case of the triangles, the intuition of similarity implies, first, that the relations of extension between the sides of the one, are compared in thought with the like kind of relations between the sides of the other. There can be no idea of similarity if a relation of coexistence between two sides of one triangle, is presented in consciousness along with some relation of extension between two sides of the other. Evidently, therefore, the primary element in the intuition of perfect similarity, is—likeness of nature between relations. And then, joined to this, is the secondary element — likeness of degree between these connatural relations. The relations must be of the same order; and each antecedent must bear to its

consequent a contrast of the same strength. In imperfect similarity however, the only implication is, likeness of nature in the relations. When, in any new case, we predicate heat as a result of compression, the implied similarity between such new case and previous cases, is simply a consciousness of connate relations, of which the two antecedents are connate and the two consequents are connate. Nothing is said of degree. The new relation between compression and heat, is simply thought of as a sequence like in kind to certain foreknown sequences; and though there may be a vague idea of the quantity of heat as varying with the quantity of compression, this is not included in the predication. Hence then, while imperfect similarity involves the connature of relations whose antecedents are connatural and whose consequents are connatural; perfect similarity involves the cointension of such connatural relations.

§ 84. So much for the elements into which the relation of similarity is resolvable, objectively considered. Subjectively considered, it may be defined as a consciousness that two successive states of consciousness are severally composed of like states of consciousness arranged in like ways: or more specifically—it is a consciousness of the cointension of two connatural relations between states of consciousness, which are themselves like in kind but commonly unlike in degree. And this being the consciousness of similarity in its simplest form, it results that when, as in ordinary cases, the similarity consists of many component similarities, each of the compared states of consciousness contains many relations that are severally connatural and cointense with the corresponding relations in the other.

Respecting dissimilarity it needs only to be said that—neglecting all those ordinary applications or rather misapplications of the word in which it is used to describe any kind of unlikeness, and confining our attention to dissimilarity proper, as existing between two geometrical figures—it is a conscious-

ness of the non-cointension of two connatural relations between states of consciousness which are themselves like in kind, but commonly unlike in degree.

The relations of similarity and dissimilarity being thus proximately decomposed into certain more general relations, the further analysis of them is involved in the analysis of these more general relations: to which let us now proceed.

CHAPTER XIX.

THE RELATIONS OF COINTENSION AND NON-COINTENSION.

§ 85. Keeping to the subjective point of view, and regarding every relation as some state of consciousness holding together other states of consciousness; it is first to be remarked that relations of cointension are of two kinds, according as the states of consciousness between which they subsist are primary or secondary—are simple states, or the relations among simple states. Of these, the kind exemplified in the last chapter, and the kind which we must here first deal with, is that subsisting between states of consciousness which are themselves relations.

Every relation between states of consciousness of necessity implies a change in consciousness. That there may be a relation, there must be two states between which it subsists; and before there can be two states there must be some change of state. On the one hand, there can be no change in the state of consciousness without there resulting two states standing in some relation; and on the other hand, there can be no relation until consciousness undergoes some change of state. These are two sides of the same necessary truth.

Now changes in consciousness differ widely in kind. The mental transition from a flash to an explosion, is totally unlike that from a touch to a burn. Between an impression produced by the colour of a rose and one produced by its odour, there is a contrast wholly different from the contrast between the impressions of hardness and transparency which a crystal gives. Differences of kind among the changes in the states of consciousness—even the undecomposable states—have indeed two orders: each of them extensive. There are the changes experienced when, from a sensation of one class, we pass to a sensation of a totally unrelated class—changes that are various in

kind; and there are the changes experienced when, from a sensation of one class, we pass to a sensation of the same class but of another species—changes that are also various in kind; though less widely unlike than the others. To speak more specifically:—We have on the one hand, such extremely different changes as those experienced on passing from a colour to touch, from a taste to a sound, from a burn to a smell, from a sense of pressure to one of cold, from a feeling of roughness to one of dazzling, &c., &c.: and on the other hand, we have the less different changes experienced on passing from one colour to another—as red to green, yellow to blue, pink to grey; or on passing from one taste to another—as bitter to sour, sour to sweet, sweet to bitter; or on passing from one sound to another, or one smell to another. Add to which, that when the transitions, instead of being from sensation to sensation, are from precept to precept, or from concept to concept, there arise other orders of changes still more varied in their kinds.

Not only, however, do changes in consciousness differ widely in *kind*, but they differ widely in *degree*. The differences in degree are divisible into two classes—those which subsist when the successive states of consciousness are unlike in nature; and those which subsist when the states of consciousness are like in nature. Thus, when some loose gunpowder is exploded, the transition from the impression of light to that of a faint sound, is not the same as the transition from the impression of light to that of a loud sound, which results when the powder is fired out of a pistol. Nor is the transition from the sensation of touch to that of temperature the same when grasping wood as when grasping iron. And evidently throughout all the various orders of changes above indicated, the like contrasts subsist. Equally multiplied and familiar are those other contrasts, subsisting between changes in consciousness that do not alter the nature of its state, but only the intensity. Thus when, of two doors intervening between his ear and some continuous sound, one is suddenly opened, the change in a

listener's consciousness is not so great as when both doors are suddenly opened. Nor, when contemplating in succession two allied shades of bright purple placed side by side, is the change in consciousness so great as on transferring the gaze from either of them to an adjacent shade of lilac. Those changes in consciousness which do not affect the nature of its state, are much more measurable than the others. Two changes of intensity in the same kind of feeling, may be known as like or unlike in degree, far more completely than two changes from one kind of feeling to another. And, indeed, it is doubtful whether these last can be considered measurable at all—whether the change from a light to a sound, being, as it were, total, must not be held as the same in degree with all other changes from light to sound; however much the relative amounts of light or sound may vary. But be this as it may, it is clear that in such cases all minor differences must be dwarfed by the greatness of the contrast; and that consequently no accurate discrimination between the changes can be made.

Now changes in consciousness, which we thus find to be various not only in kind but in degree, are themselves cognizable as states of consciousness: not indeed as simple states; but as states in which the transition between two states is the thing contemplated. That the change, the link uniting the two states, is nothing separate from, and nothing additional to, the states themselves, seems manifest. That consequently, it cannot be thought of without thinking of the states themselves, seems also manifest. And that to be conscious of it, is simply to be conscious of the two states in succession, seems equally manifest. But at the same time it is unquestionable that we have the power of thinking of the change itself, as something more than the two states individually considered. Possibly there may be a physiological reason for this. Certain facts point to the conclusion that the change itself constitutes a fleeting state of feeling, separate from the less fleeting states which it links together. Every one knows that a violent change in the sensations is accompanied by a species of shock,

Even though expecting it, a bright flash of light will cause the eyes to wink; and yet light of the same brilliancy, if continuous, can be steadily looked at without difficulty. The sudden application of cold water to the skin produces a start, notwithstanding a previous determination to bear it unmoved; and yet the sensation of cold, when once established, can be borne with equanimity. Nay, extremely marked transitions among the ideas will occasionally produce an analogous effect. Probably many can call to mind cases in which, from the sudden remembrance that something important had been forgotten, or from the reception of unexpected good news, a sensible shock was experienced. And indeed the serious injuries sometimes resulting from violent changes of mental state, sufficiently imply that such changes must be accompanied by a decided feeling. Whence it may be inferred, that as the violence of changes in the state of consciousness is altogether a thing of degree, all such changes are accompanied by some feeling however slight.

But whether a change in consciousness be or be not knowable as something more than the juxtaposition of a preceding and a succeeding state, it is undeniable that we can so think of changes in consciousness as to distinguish their various kinds and degrees. In whatever way I cognize the transition from a sensation of touch to one of sound, it is beyond question that I can think of it as unlike in kind to the transition from a sensation of touch to one of cold. Whether, in thinking of a change, I think of the two successive states, or of the contrast between them, it remains alike true, that in passing from an impression of the brightest green to one of bright green, and from one of bright green to one of pale green, I am conscious of two changes which are the same in kind but different in degree. And to say that I am conscious of these changes as such or such, *is to say that they are states of my consciousness.*

Thus then, having the ability to think, not only of the original simple states of consciousness, but also of the changes

among them—being conscious of differences in kind and degree, not only between successive sensations, but also between successive changes in sensations—it results that these changes are classifiable as the original sensations are. As two sensations can be known as like or unlike in kind; so can two changes among them be known as like or unlike in kind: and as two sensations that are like in kind can be known as like or unlike in intensity; so can two changes among them that are like in kind, be known as like or unlike in intensity. We can recognize changes as connatural; or the reverse: and connatural changes we can recognize as cointense; or the reverse.

But, as above pointed out, these that we have been treating of as changes in consciousness, are nothing else than what we call relations. There can be no phenomena of consciousness beyond its successive states, and the modes of succession of its states—the states themselves, and the changes from one state to another. And seeing that what we are conscious of as relations, are not the primitive states themselves, they can be nothing else than the changes from state to state. The two answer in all respects. We can think neither of a change nor of a relation, without thinking of the two terms forming its antecedent and consequent. As we cannot think a relation without a change in consciousness from one of its terms to the other; so we cannot think a change without establishing a relation between a preceding phenomenon and a succeeding one. Though some of them are eventually so transformed as to appear of another nature, yet, primarily, all that we class as different orders of relations, are nothing but different kinds and complications of changes among the states of consciousness.

In subsequent chapters sundry developments of this doctrine will be found. Here, we have merely to observe its bearing on the inquiry before us. Relations, subjectively considered, being nothing but changes in the state of consciousness, it follows that the cointension of relations is the cointen-

sion of such changes; or in other words—likeness in degree between changes like in kind.

§ 86. After what has been said, not much need be added respecting the simpler species of the relation of cointension: that, namely, of which the terms are not relations among states of consciousness, but the primary states of consciousness themselves. This is of course definable as—likeness in degree between sensations like in kind.

Nor, respecting the relation of non-cointension is it requisite to say more than that it is unlikeness in degree between either changes like in kind or sensations like in kind.

The only further remark that may here fitly be made, is one concerning the use of the words cointension and non-cointension to denote these orders of relationship. All our ideas of intensity, when traced to their origin, manifestly refer to the degrees of our sensations. Intensity is a word that connotes some species of force—a force that is violent, vehement, severe, keen, ardent; and all our ideas of force ultimately refer to sensations. We speak of intense heat and cold, intense pressure, intense pleasure and pain, intense passion, intense bitterness and sourness, intense irritation, restlessness, itching: in all of which cases we speak of feelings in respect to their degree. Hence then, in comparing simple states of consciousness that are alike in kind, we observe their relative intensities. If their intensities are equal, they must be called cointense: and the equality of their intensities is cointension. Add to which, that as the changes in consciousness are also different in respect of their violence, and are seemingly accompanied by some species of sensation, they also are comparable in respect to their intensity: whence it follows that cointension is predicable of such changes, that is relations, when they are alike in kind and degree.

CHAPTER XX.

THE RELATIONS OF COEXTENSION AND NON-COEXTENSION.

§ 87. As was shown when treating of Space and of the statical attributes of Body, all modes of extension are resolvable into relations of coexistent positions. Space is known to us as an infinitude of coexistent positions that do not resist: Body as a congeries of coexistent positions that do resist. The simplest extension therefore, as that of a line, must be regarded as a certain series of coexistent positions; equal lines, as equal series of coexistent positions; and coextension, as the equality of separate series of coexistent positions—that is, the sameness in the number of coexistent positions they include.

It was explained at considerable length, that a series of coexistent positions is known to the adult mind, through the simultaneous excitation of some series of independent sensitive agents distributed over the surface of the body: either those extremely minute and closely packed ones of which the retina consists, or those more sparingly dispersed and less individualized ones supplied to the skin. And it was also explained, that the simultaneous excitation of any series of such agents becomes known as the equivalent of their serial excitation; or rather—is a transformation of a series of states of consciousness known as having successive positions, into a quasi single state of consciousness in which these component states are presented in synchronous positions, or coexistent positions: and that these coexistent positions can become known as such, only through the previous establishment of the serial positions to which they correspond—only though those serial excitations of consciousness that result from the motion of images over the retina and objects over the skin. Whence it follows that while, eventually, extension is known in a quasi

single state of consciousness produced by the synchronous excitation of a number of independent nerves, either tactual or visual; it is originally known through a series of states produced by the successive excitation of such nerves. Add to which that these synchronous excitations being simply the equivalents and symbols of the successive ones, on which they are based, and to which they are always reducible, the successive ones are those in which all phenomena of extension, subjectively considered, must ultimately be expressed.

Reduced to its lowest terms then, extension is knowable as some series of states of consciousness. But what series? Consciousness is ever passing through a series of states; but is not ever occupied about extension. In the first place then, the series is to be distinguished as more or less homogeneous. The successive states of which it consists must not be of many kinds, but of one kind—must be connatural. But this is not enough; for there are various successions of connatural states —as those produced by heat, odour, or continuous sound—which are not constituents in the idea of extension. Hence then, extension, as originally known, must be some series of connatural states of consciousness of a special order; and as before shown (§ 71) it must, in its primary form, be that order of states produced by the united sensations of motion and touch. Two equal extensions then, are originally known to us as two equal series of sensations of motion and touch. And coextension, when reduced to its lowest terms, means—equality in the lengths of such series; that is—equality in the numbers of the states they severally include.

Two objections to this definition should be noticed. It may be remarked, with apparent truth, that it is a misuse of language to call that which we feel when drawing a finger over the skin, a *series* of states of consciousness; seeing that the sensations of motion and touch are continuous—are not divided into successive sensations. But saying nothing of the fact that the nerves that are one after another excited by the moving finger are really independent, and must therefore be supposed actually

to send successive feelings to the sensorium; it will suffice to reply, that though, in cases of this kind, the state of consciousness is apt to seem unbroken and homogeneous, it is in fact, marked out into a great number of separate portions. For it must be remembered that the very condition on which only consciousness exists, is, perpetual change. If, while a continuous sensation like the one in question were being received, consciousness could be solely occupied with it, there would—if the hibernicism may pass—be no consciousness.* A little consideration will show, that during one of these seemingly homogeneous states of consciousness, produced by a persistent sensation, the attention is transitorily occupied with various other things—with surrounding objects, with sounds, with the idea of self, &c. &c.—none of which are wholly absent from the mind. Whence it is clear that what we are liable to take for an unbroken state of consciousness, is really a state broken by numerous incidental states—by fleeting thoughts, which, passing through it, serve to divide it out into portions, and reduce it to a series of states. The second objection is, that coextension, as ordinarily determined by the juxtaposition of the coextensive objects, involves no comparison between two series of states of consciousness; but merely an observation that the ends of the objects coincide: and this is true. But it is clear that this mode of ascertaining coextension is nothing but an artifice, based upon the experience that extensions separately known to us through the equal series of states they produce, always manifest this coincidence of their ends when placed side by side. And as we are here dealing, not with the artificial test of coextension, but with the notion of coextension as it naturally arises, the objection is invalid: more especially as we have thus far considered, not the developed consciousness of coextension, but that primary consciousness out of which it is developed.

§ 88. After what has been said, the nature of our developed

* A truth illustrated by the fact, that when, as under intense agony, the sensation ultimately becomes strong enough totally to exclude all thoughts—totally to absorb consciousness—consciousness ceases: the patient faints.

consciousness of coextension will readily be understood. The successive impressions through which extension is originally presented, having, by a process repeatedly described, been transformed into synchronous impressions—the whole chain of connatural states, at first known in their serial positions, having become known in their coexistent positions; it follows that the consolidated states of consciousness thus resulting, can be compared, and their likeness or unlikeness recognized, just as the chains of states to which they are equivalent can: or rather, they can be known as like or unlike, because the chains to which they are equivalent are known as like or unlike. When two equal lines cast their images upon the retina, the range of sensitive elements excited by each, having been primarily known as a series of states of consciousness; and the two series having been known as equal series; the equality manifestly becomes as predicable of the consolidated states as it was of the serial states. Each of these consolidated states is produced by the simultaneous stimulation of a certain number of independent nerves of a particular kind; and, physiologically considered, that likeness in the two states which constitutes the intuition in question, results from a likeness in the number and combination of the independent nerves simultaneously affected.

As implied by much that has gone before, it is this simultaneity in the excitation of independent nerves, which gives the notion of coexistence, underlying that of extension, and therefore that of coextension. Though, as will presently be shown, the relation of coexistence is not originally disclosed to consciousness by this simultaneity of excitation; but can only be so disclosed after experience has proved the independence of the simultaneously excited nerves; yet, it is only when it has come to be thus disclosed, that extension and coextension, as we comprehend them, can be conceived: seeing that extension implies coexistence in the parts of the thing extended; and, conversely, coexistence implies a duality which is impossible without space. Extension, therefore, as known by the developed mind, being made up of many elementary consciousnesses of coexistence;

the relation of coextension cannot be exhaustively analyzed without analyzing the relation of coexistence. But in so far as the nature of our consciousness of coexistence has been incidentally explained, the relation of coextension, as subjectively considered, may be understood—may be defined as the likeness of two composite states of consciousness, visual or tactual, in respect of the number and order of the elementary relations of coexistence which they severally include: such composite states of consciousness being severally produced by the consolidation of what were originally known as serial states.

To which, for form's sake, it may be added, that the relation of non-coextension is definable as the unlikeness of such two composite states of consciousness.

CHAPTER XXI.

THE RELATIONS OF COEXISTENCE AND NON-COEXISTENCE.

§ 89. It is tolerably evident, even *à priori*, that, simple as it seems, the relation of coexistence is in reality compound. Though, in the adult mind, apparently undecomposable, yet it is a corollary from very obvious truths, that this relation is originally synthetic. For as coexistence implies two things; as, further, the two things which coexist, cannot occupy consciousness at the same instant; and as they cannot pass through consciousness in simple succession—seeing that they would then be known as sequent and not coexistent—it follows that coexistence can be disclosed only by some duplex act of thought. It is true that the two terms of a relation of coexistence—as the ends of a line at which we look, or the opposite sides of a stick which we grasp—ordinarily appear to be known, not in two states of consciousness, but in one. But it needs only to call to mind the extremely complex process by which our perceptions of objects are built up; and to remember that what in the infant is an elaborate synthesis, afterwards becomes an instantaneous and, as it would seem, direct cognition; to see that no apparent simultaneity in the consciousness of the two things between which there is a relation of coexistence, can be taken as disproving their original seriality. Leaving general considerations however, let us look at the matter more nearly.

If the eyes be directed to two small dots placed close together upon a sheet of paper, the facts that there are two, that they coexist, and that there is a certain space between them, certainly appear to be given in the same immediate intuition: and it seems a scarcely credible proposition that by a nascent intelligence they can neither be known as two, nor as coexistent, nor as having relative positions. But on re-reading § 58

it will, I think, become clear that at first, any two such dots can produce nothing but an indefinite visual sensation, as simple as one of sound or smell. For as was shown, the possibility of distinguishing the image upon the retina as consisting of not one impression, but of two, implies in the first place, that the retina consists of parts capable of being separately excited; seeing that were it but the expansion of one nerve, the stimulation of any part would produce the same effect upon consciousness, while the stimulation of two or more parts could do nothing but increase the intensity of the sensation. And it implies in the second place, that the separate stimulations of these separate parts are distinguishable from one another by consciousness; seeing that did they all produce one effect on consciousness, the result would be the same as though they were one. But before the separate stimulations of these separate parts can be distinguished from one another by consciousness, there must be some experiences. For the two parts of the retina simultaneously affected by the images of two points, to be known as yielding two sensations and not one sensation, implies a knowledge of the parts as separate; and to suppose that this can exist anterior to experience is absurd. Or to state the case more conclusively:—Coexistence being unthinkable without a space in which the things may coexist, it follows that the two points described, cannot be known as coexistent without being also known as out of each other—as at some distance from each other. But, as before explained, to suppose that when two sentient points on the surface of the organism are first simultaneously stimulated, some particular distance is thereby suggested, is to fall into the absurdity of supposing that an idea of some particular distance already exists in the mind (§ 58). Evidently then, as by a nascent intelligence, the space between the two coexistent points is incognizable; and as their coexistence cannot be otherwise conceived, it follows that at first they cannot be known as coexistent.

From all which it is an obvious corollary, that the relation of

coexistence is disclosed by the same experiences that disclose extension. But now we have to observe concerning these experiences, a fact not before noticed. The repeatedly described consolidation of serial states of consciousness into quasi single states, is not the whole of the process by which the ideas of coexistence and extension are evolved. It is the peculiarity alike of every tactual and visual series which enters into the genesis of these ideas, that not only does it admit of being transformed into a composite state, in which the successive positions become simultaneous positions, but it admits of being reversed. The chain of states of consciousness, A to Z, produced by the motion of a limb, or of something over the skin, or of the eye along the outline of an object, may with equal facility be gone through from Z to A. Unlike those states of consciousness constituting our perception of sequence, which do not admit of an unresisted change in their order, those which constitute our perception of coexistence admit of their order being inverted—occur as readily in one direction as the other. And this is the especial experience by which the relation of coexistence is disclosed. Let us glance at the chief phases of this experience.

Recurring to the adjacent dots, it will be observed on experiment, that though very close and very small, they can never be both *perfectly* present to consciousness at the same time. The one on which, at any moment, the visual axes converge, is alone perceived with complete distinctness. The other, though, as it would at first seem, very clearly before the mind, cannot be perceived with the highest degree of definiteness until the visual axes converge upon it; and when the gaze is thus transferred, the dot first contemplated ceases to be so definitely perceived. Moreover, if, while the eyes are fixed upon one of the dots, the thoughts are directed to the other, it will be found that in proportion as the other is distinctly thought of, the one to which the eyes are directed tends to lapse out of consciousness. Both which facts go to show, alike that the serial experiences which originally gave the knowledge of coexistent

positions, never wholly cease to be used; and that, even under the most favourable circumstances, the two terms of a relation of coexistence are not present to the mind with equal distinctness; but that while the one is clearly before consciousness, the other is nascent in a higher or lower degree. Let us now observe what happens when the dots are further apart. If they are extremely minute, it will be found that even at the distance of an inch apart, the one is invisible when the eyes are directed to the other, and cannot be known as coexistent with it except by a definite transfer of the attention. If they are dots of moderate size, the consciousness of one will be accompanied by some consciousness of the other until they are separated by a space of six or eight inches; beyond which, this nascent consciousness wholly ceases. With still larger objects, there must be a still larger interval—or, more strictly speaking, a still greater subtended angle—to produce the same result. But however large the objects, it will be found that there is a distance at which either ceases to be in any degree presented to the mind, when the eyes are directed to the other. The unregarded object, when gradually removed to the outskirts of the field of view, does not disappear suddenly; but fades into nothingness so gradually that it is impossible to say when the nascent consciousness of it wholly ceases. And as, between those relative positions in which the coexistence of two objects can be known only by a slight turn of the head, and those in which it can be known only by turning the head half round, there is also a series of imperceptible transitions; it follows that the coexistence of two dots lying close together, and that of two objects lying respectively behind and before the observer, are known in modes which, however apparently different, are united by insensible gradations, and must be primordially the same. In both cases, the terms of the relation of coexistence cannot be perfectly present to consciousness at the same moment. In both cases, motion is required to bring that term of the relation of which there is either no consciousness or but imperfect consciousness, distinctly before the mind. And the differences

are simply between the degrees of motion, and between the degrees in which the consciousness is nascent.

This being understood, let us consider in what way we can know the coexistence of two things not visible together. When an adult, having just seen some object A, immediately after sees another object B, he usually asserts their coexistence on the strength of this single observation. He is manifestly enabled to do this by an accumulation of previous experiences; from which he has drawn the induction that certain groups of phenomena are persistent. But what does he mean by persistent? He means that the phenomena are of a kind which he can again become conscious of with the same vividness as before. He means that on turning round his head, the object A, will again impress him as it did at first. The entire contents of his assertion that A and B coexist, is, that the states of consciousness which they severally produce in him, can be alternated as often as he pleases. Leaving, however, the coexistence that is known inferentially, we must here concern ourselves with those primordial experiences which first disclose it. By an incipient intelligence, the impressions produced by the two things A and B, seen in succession, cannot be known to differ in their persistence from two sounds heard one after the other. In either case, there is nothing but a sequence of states of consciousness. How then, does the one relation come to be distinguished from the other? Simply by finding that whereas the terms of the second sequence cannot be known in the reverse order with equal vividness, those of the other can. It is perpetually found that while certain states of consciousness follow one another with as much facility and clearness in one direction as in the opposite (A, B—B, A) others do not; and hence results a differentiation of the relation of coexistence from that of sequence. And not only is it that coexistence is originally thus known; but, as just pointed out, it is that, subjectively considered, our whole knowledge of the relation of coexistence consists in recognizing the equal facility with which the terms of the relation will pass through consciousness in either order.

Still more manifest will this become, when it is observed that there are coexistences which even the adult never knows otherwise than through this test. Now that I am writing, I feel in my foot the warmth of the fire; I am further aware of the pressure of my arm upon the desk, and my back against the chair; I see the paper on which I write; and I hear a rumble in the street. I find it quite impossible, however, to think of all these things at the same instant: I cannot unite the heat, the sound, the pressure, and the whiteness, in the same state of consciousness. How then do I know that I am receiving these various impressions at one time? How do I know that the external objects producing them are coexistent? Simply from the fact that I can be successively conscious of these various feelings in any order with equal facility. And could I not do this, I should not know the corresponding phenomena as coexistent.

§ 90. The equal facility with which the terms of a relation of coexistence can be thought of in either order, is evidently knowable by us simply through an internal feeling. That we habitually notice the feelings accompanying changes in consciousness, is proved by the fact that we distinguish them by words. When we speak of a thing as *hard* to think, or *easy* to believe, we express by these adverbs the presence or absence of a certain mental tension. In the one case, the antecedent and consequent of the thought can be made to follow only by a great effort; in the other, by little or no effort. When attempting to remember a name we have forgotten; or when forcing ourselves to reflect on some subject to which we are averse, or of which we are tired; or when trying to form an unusually complex conception; we are distinctly conscious of an inward strain. Whence it is clear, that the states of consciousness constituting a thought, may follow one another either with facility or with any degree of difficulty; and that the facility or difficulty of a transition is known to us by its accompanying sensation.

Hence then, when it is said that the relation of coexistence is one of which the terms will follow one another through consciousness in either order with equal facility, the thing asserted is, a likeness or equality of the two feelings which accompany respectively, the change from antecedent to consequent, and the change from consequent to antecedent. Not a likeness or equality of the two feelings produced by the contrasts of the terms; for these must differ according to the order in which the terms are contemplated; but a likeness or equality of the two feelings of resistance—or rather in this case, non-resistance—which occur at the moments of transition.

So that the relation of coexistence is to be defined as a union of two relations of sequence, such that while the terms of the one are exactly like those of the other in kind and degree, and exactly the reverse in their order of succession, they are exactly like them in the feeling which accompanies that succession. Or otherwise, it may be defined as consisting of two changes in consciousness, which, though absolutely opposite in other respects, are perfectly alike in the absence of strain. And of course the relation of non-coexistence differs in this, that though one of the two changes occurs without any feeling of tension, the other does not.

§ 91. It may be worth while just to point out, that these conclusions are indicated even by *à priori* considerations. For if, on the one hand, the great mass of outward things are statical, are persistent, are not manifesting any active change; and if, on the other hand, perpetual change is the law of the inner world —is the primary condition under which only consciousness can continue; there arises the question—How can the outer statical phenomena, be ever represented by the inner dynamical phenomena? How can the no-changes outside, ever be symbolized by the changes inside? That changes in the *non-ego* may be expressed by changes in the *ego*, is comprehensible enough; but how is it possible that objective rest, can be signified by subjective motion? Evidently there is only one possibility. A

consciousness ever in a state of change, can represent to itself a no-change, only by an inversion of one of its changes—by a duplication of consciousness equivalent to an arrest—by a regress which undoes a previous progress — by two changes which exactly neutralize each other.

Finally, the reader should be reminded that this analysis of the relation of coexistence, resulting as it does in the conclusion that it is a relation disclosed by experience, supplies the ultimate disproof of the hypothesis that Space is a form of thought; seeing that the cognition of coexistence is the primitive element out of which the cognition of space is built—is the element without which even the germ of that cognition is impossible.

CHAPTER XXII.

THE RELATIONS OF CONNATURE AND NON-CONNATURE.

§ 92. After what has already been said concerning it (§ 85), but little need here be added respecting the relation of connature. It is of two kinds. In the one kind, the terms between which it subsists are themselves relations, or changes in consciousness: in the other, they are the primitive states of consciousness between which such changes occur. Let us first glance at the more complex of these.

When treating of the relation of cointension, it was pointed out that changes in consciousness are of several classes. There are those in which the antecedent and consequent states are of different orders—as when the transition is from a sound to a smell; those in which they are of the same order, but of different species—as when the transition is from a sound of low pitch to one of high; and those in which they are of the same species, but of different degrees—as when the transition is from a faint sound to a loud one. And these being the different kinds of change between states of consciousness produced by simple sensations, it is manifest that when the states of consciousness become composite, a great multiplicity of kinds of changes arise—changes from greater to less in magnitude, from slow to quick in velocity, from ascent to descent, &c. Hence those various orders of change implied by the negations of the relations already treated of—the changes indicated by the terms dissimilarity, non-cointension, non-coextension, non-coexistence. And hence also those processes of consciousness in virtue of which we class lines with lines, areas with areas, bulks with bulks—all of them distinguished by us as different orders of relations; that is, different orders of changes among the states of consciousness.

Nothing is to be said respecting the connature of relations in its various modes, beyond describing it; for it is clearly a relation that is not decomposable into other relations. That two changes in consciousness are of like kind, is a fact of which we can give no account further than that we perceive it to be so. Simple or complex as the states of consciousness themselves may be, it is manifest that the transition from state to state is in all cases simple; and when two of these transitions produce in us two like feelings, we know nothing more than that we have the like feelings. It is true, as will be shown in a subsequent chapter, that it is possible to say specifically what we mean by asserting the likeness of these feelings. But beyond this it is impossible to go.

As subsisting between relations, therefore, the relation of connature must be defined as—likeness of kind between two changes in consciousness.

§ 93. Respecting the relation of connature as subsisting, not between relations, but between primary states of consciousness—sensations or the representations of them—still less is to be said. What is the nature of the feelings which we have of warmth, of blueness, of pressure, of sweetness, no one can say. They are undecomposable elements of thought with which analysis can do nothing. And when we predicate the connature of any two such sensations—their likeness in kind—we express an intuition of which we can say nothing further than that we have it. Though, as will by and by be seen, the intuition may be otherwise expressed, it cannot be decomposed.

Save to justify the title of the chapter, it is scarcely needful to add, that the relation of non-connature is—unlikeness in kind between either changes in consciousness or the states which they connect.

CHAPTER XXIII.

THE RELATIONS OF LIKENESS AND UNLIKENESS.

§ 94. At length continued analysis has brought us down to the relations underlying not only all preceding relations, but all processes of thought whatever. From the most complex and most abstract inferences of the developed man, down to the most rudimentary intuitions of the infant, all intelligence proceeds by the establishment of relations of *likeness* and *unlikeness*. Duly to realize this fact, we must glance at the successive conclusions arrived at in preceding chapters.

In the most perfect kinds of compound quantitative reasoning, we found that each of the several intuitions through which any conclusion is reached, not only involves the relation of *likeness* under its highest form—that of *equality*—but involves it in the most various ways. We found that in descending step by step to the lower kinds of reasoning, the intuitions of *likeness* included in each ratiocinative act, become less numerous and less perfect; but that to the last, *likeness* of relations is necessarily involved. The classification of objects, we found to imply a perception of the *likeness* of a new group of relations to a before-known group, joined with more or less *unlikeness* of the individual attributes; while recognition implies *exact likeness*, both of the individual attributes and their relations, to those of groups before known. And we further saw that the perception of a special object is impossible save by thinking of it as *like* some before-known class or individual. The perception of Body, as presenting its three orders of attributes, we found to imply a classing of the several attributes, their relations to each other, and the conditions under which they are disclosed, with *like* attributes, relations, and conditions. It was shown that our ideas of Space, Time, and Mo-

tion, arise by a discovery of the *equivalence* of certain states of consciousness, serial and simultaneous; and further, that no particular space, time, or motion can be thought of, without the relation of *likeness* being involved. More recently, we have seen that the higher orders of relations are severally resolvable into relations of *likeness* and *unlikeness* whose terms have certain specialities and complexities. Similarity, was defined as the cointension of two connatural relations between states of consciousness which are themselves *like* in kind but commonly *unlike* in degree. Cointension, we found to be, *likeness* in degree between either changes in consciousness that are like in kind, or states of consciousness that are *like* in kind. It was shown that coextension is the *likeness* of two composite states of consciousness, in respect of the number and order of the elementary relations of coexistence which they severally include. Coexistence, was resolved into two sequences whose terms are exactly *alike* in kind and degree, exactly *unlike*, or opposite, in their order of succession, and exactly *alike* in the feeling which accompanies that succession. Connature was defined as *likeness* in kind between either two changes in consciousness, or two states of consciousness. And each of these relations we found to have its negative, in which *unlikeness* is the thing predicated.

Seeing thus, that the knowing of successive states and changes of consciousness as like or unlike, is that in which thinking essentially consists, we have next to inquire what is the essential nature of those phenomena in consciousness which we signify by the words likeness and unlikeness. Are the relations of likeness and unlikeness definable? And if so, what are they?

§ 95. Things cannot be truly defined except in terms more general than themselves: and hence, unless there is some relation underlying the relations of likeness and unlikeness, they must be indefinable. Strictly speaking, no such more general relation exists. The only relation yet remaining to be dealt

with, is one that is co-ordinate with them—one that lies upon the same plane with them—one that is in fact another side of the same mental phenomena. All that is possible for us, is, to describe likeness and unlikeness in terms of this remaining relation; and to describe this remaining relation, when we come to it, in terms of likeness and unlikeness—to exhibit them as the necessary complements of each other.

This premised, the question above asked will be most readily answered by comparing the relations of likeness and unlikeness together. The essential nature of each will best be shown by contrast with the other. In what then consist the difference between the two mental processes by which these relations are disclosed?

If I cut in two a sheet of coloured paper—say blue—and place the pieces at some distance apart; and if I also place at some distance apart, two other pieces which are of different colours—say red and green; I have in the first pair a relation of likeness, and in the second pair a relation of unlikeness. In what consists the knowledge of each of these relations? On glancing from one of the blue pieces to the other, I am conscious of passing from one state to another state, which is new in so far as it is separate from, and subsequent to, the first, but which is not new in any other respect. On glancing from the red to the green, I am conscious of passing from one state to another state, which is new not only as being subsequent, but which is otherwise new. Suppose now that I place the blue pieces quite close together, joining the two edges that were cut; and that I also place the red and green pieces close together. What happens? The two blue pieces are not now known in two distinct states of consciousness: the two states of consciousness practically merge into one. The red and green pieces however, placed no matter how close, still produce two states when contemplated. Similarly again with odours. A flower when smelt at, produces a certain continuous state of consciousness. If another flower of the same kind be joined with it, and the two are moved about under the nostrils, the

successive scents may be made to seem as continuous as the scent of one. But if the flowers are of different kinds, they will, when successively smelt at, produce different states of consciousness. The like is true of sounds. A sustained note from a wind or stringed instrument, may be perfectly homogeneous, or it may be interrupted by some scarcely appreciable flaw, serving nominally to divide it into two notes that are exactly alike. But while, when we listen to such a note, consciousness may with almost equal propriety be considered in one state or two states; when we listen to any musical interval, we very decidedly experience two states. And this antithesis between the relations of likeness and unlikeness, will be yet further elucidated, when it is remarked that not only do the states of consciousness which we call like, lapse insensibly into one state, but that any one state of consciousness having an appreciable continuity, may be conceived as divided out into a series of like states.

From all which it will be sufficiently manifest, that by the words unlike and like, we signify the occurrence or non-occurrence of *change* in consciousness. Leaving out of sight for a moment that fleeting state of consciousness which marks a transfer of the attention, and which strictly considered is a change, we may say that by unlikeness and likeness we mean respectively, *change* and *no change* in consciousness. The two terms of a relation of unlikeness, are two states of consciousness forming the antecedent and consequent of a *change* in consciousness: the two terms of a relation of likeness, are the antecedent and consequent of what, in one sense, is *no change*; seeing that it leaves consciousness in the same condition as before.

As implied however, this is but an approximate statement—an adumbration, which, if interpreted strictly, describes an impossibility. For, as the relation of likeness implies two terms, two states of consciousness; and as two states of consciousness, if not themselves different, cannot exist as separate states unless they are divided from each other by some state

that is different; it follows that a relation of likeness implies a change, or rather changes, in consciousness. Accurately speaking, therefore, a relation of likeness consists of two relations of unlikeness which neutralize each other. It is a change from some state A to another state B (which represents the feeling we have while passing from one of the like things to the other), and a change from the state B to a second state A; which second state A would be indistinguishable from the first state were it not divided from it by the state B, and which merges into such first state when the state B disappears, from the approximation of the two like stimuli in space or time.

Very many relations of unlikeness similarly consist of two relations of unlikeness, which, however, do not neutralize each other. In all cases where the two terms of the relation do not follow through consciousness in juxtaposition—as when the unlike things looked at are some distance apart, or when between unlike sounds or odours a brief interval of time elapses—there are three states of consciousness involved; the original state A, the transition state B, and that state of which we predicate unlikeness, C. But the primordial relation of unlikeness is one consisting of two states only. When two notes differing in pitch, strike the ear in rapid succession, so as to leave no time for any intervening thought or sensation—when a flash of lightning for a moment dispels the darkness—when any one state of consciousness is supplanted by another state, there is established a relation of unlikeness.

Thus, then, the relation of unlikeness is the primordial one—is the relation involved in every other relation; and can itself be described in no other way than as a *change* in consciousness.

CHAPTER XXIV.

THE RELATION OF SEQUENCE.

§ 96. As was said in the last chapter, this remaining relation is but another side of the fundamental one there treated of. Sequence is change; and change, as known by us, is the unlikeness of a present state of consciousness to a past state. While on the one hand, the two terms of a relation of unlikeness cannot be known without a change in consciousness; on the other hand, there can be no change in consciousness without there being two states standing in a relation of unlikeness. The fundamental, the undecomposable relation must have two terms—two adjacent states of consciousness. If these are thought of in themselves, they must be thought of as unlike; otherwise they will constitute not two states but one. If they are thought of as states of consciousness, they must be thought of as constituting a sequence; seeing that consciousness cannot be in two states at one time. The ultimate relation, therefore, is nothing more than a *change* in the state of consciousness: and we call it either a relation of unlikeness or a relation of sequence, according as we think of the contrast between the antecedent and consequent states, or of their order.

Beyond thus describing each aspect of this relation in terms of the other, no account can be given of it. Like every primordial experience—like the sensation of redness or that of warmth, it transcends analysis. All that can be done is to divide the relations of sequence into their respective classes; and to inquire in what manner these are distinguished from one another in consciousness. To do this completely, is by no means easy; and would moreover occupy more space than can here be afforded. It must suffice to describe the leading dis-

tinctions, so far as is requisite to show their harmony with the general results of the analysis.

§ 97. It is tolerably manifest that these distinctions cannot be originally given in the consciousness of the sequences themselves. By a nascent intelligence, the relation between two sensations that severally answer to some external cause and effect, cannot be known as different in nature from that between two sensations that follow one another fortuitously. In so far as its incipient experience is concerned, there is no difference. The two relations are two changes in consciousness, and nothing more. If then, some changes, some sequences, are afterwards found to be of a different quality from others, it must be in virtue of a collateral property additional to the succession itself —a collateral property disclosed by further experience. What is that property?

The comparison of a few cases will indicate the answer to this question. After hearing in immediate succession two notes of different pitch, not the least difficulty is found in making those notes—or rather, the ideas of them—pass through consciousness in the reverse order. After an ascending fifth has been struck upon the piano, it is easy so to represent the sounds to the mind as to make a descending fifth. That is to say, the two states of consciousness produced may readily be re-thought in inverted sequence. Not that the two states thus voluntarily changed in their order, are entirely like the original states. Though they are like in nature, they are widely unlike in intensity. While the original states, which we know as two sensations of sound, are vivid, the two ideas which we find may be reversed in succession, are but very faint repetitions of them. And this it is which distinguishes one of these reversable sequences from a coexistence. If the successive states of consciousness **A, B,** will occur in the opposite order **B, A,** without any diminution of vividness, the relation between them is that which we know as coexistence. But if the states **A, B,** when they occur in opposite order, do so only as the weak states B, A,

the relation between them is that of reversable sequence. Thus much to prevent misapprehension. What it now concerns us to observe, is, that there are sequences whose terms having been presented to consciousness in one order, admit of being represented to consciousness in the opposite order with great facility. Not that they occur in this opposite order with as much facility as in the original order. Two impressions that were experienced in a certain succession, tend, when recalled, to pass through consciousness in a like succession; and it is in virtue of their tendency to do this, that we know them to have occurred in that succession; or rather, it is their recurrence in this succession which *constitutes* our knowledge of their original succession. But though, when uninterfered with by the will, the represented impressions follow one another in an order like that in which the presented ones followed; yet, in cases such as the one instanced, the slightest effort of volition suffices to reverse the order—an effort so slight as to be unaccompanied by any sense of tension. That *some* effort is required, is to be inferred from the fact that while the represented impressions *involuntarily* follow one another in the original order, they do not follow in the opposite one, unless *voluntarily*. But this is the sole appreciable distinction. Thus, then, we find that there is a certain order of sequences which have the peculiarity, that they may be represented to consciousness in reverse order with but a nominal effort. And these are the sequences which, objectively considered, we class as *accidental*.

But if, instead of two phenomena that have occurred in a merely fortuitous succession, or in a succession whose genesis is so complex as to seem fortuitous to us, we take two phenomena which occur in a certain order with considerable regularity, and examine the relation subsisting between the states of consciousness severally answering to them, we shall find it to be of a somewhat different quality. Take, for example, the shouting to any one, and the turning of his head. Frequently as these two phenomena have been known to us in this order,

the occurrence of the one almost inevitably suggests the other. If the first be presented to consciousness, it is only by an effort that the other can be prevented from following it. Moreover, the impressions have no tendency to pass through consciousness in the opposite order. The turning of another person's head, does not make us think of a shout. Nevertheless, there is little or no difficulty in reversing the order of these states. The thought of a person turning his head, may be instantly followed in consciousness by the thought of a shout. Sequences of this kind then, are distinguished by the peculiarity that though, when the antecedent is presented or represented in consciousness, a representation of the consequent cannot without difficulty be prevented from rising; yet these two states can readily have their order of succession changed. And this is the character of the sequences which, objectively considered, we class as *probable*.

When, however, we pass from *non-necessary* sequences to *necessary* sequences, we not only find that the states of consciousness are so connected that when the antecedent is presented, it is next to impossible, if not impossible, to prevent the consequent following it; but we find that the antecedent and consequent do not admit of transposition. As an illustration of the first peculiarity, may be taken our inability to think of a heavy weight as breaking the string by which it is suspended, without thinking of the weight as falling. And the last peculiarity is illustrated in the fact, that the relation between a blow and an antecedent motion, cannot be represented to the mind in the reverse order.

§ 98. Thus then, the relation of sequence, considered subjectively as simply a change in consciousness, is of three general kinds. The fortuitous, in which the two terms are as nearly as may be *alike* in their tendency, or want of tendency, subsequently to suggest each other; and in which the change may be reversed in thought, with a feeling of non-resistance *like* that with which it originally occurred. The probable, in which the

terms are *unlike* in their tendency to suggest each other; but in which the usual order of the terms may readily be inverted. And the necessary, in which the antecedent being presented or represented to consciousness, the consequent cannot be prevented from following; and in which the direction of the change cannot be changed.

This statement, imperfect as it is, and requiring though it does much to be said in explanation of difficulties that may be suggested, will serve to show, what it here chiefly concerns us to note, that the classification of sequences is itself effected through other sequences. The classification, depending as it does upon the different modes in which the sequences comport themselves when tested, involves, in the outset, the ideas of *like* and *unlike;* while the process of testing them, is itself an observing of the degrees of *likeness* or *unlikeness* between certain feelings which they severally yield under experiment. And as the relations of likeness and unlikeness are the one a double, and the other a single sequence, it results that the classing of sequences implies the making them the terms of secondary sequences. As all the relations are finally reducible to one, which is nothing else than a *change* in consciousness, it follows, even *à priori*, that all relations among the changes in consciousness must themselves be other changes.

CHAPTER XXV.

CONSCIOUSNESS IN GENERAL.

§ 99. Thus we have arrived at the result that consciousness consists of changes combined in special ways. Successive decompositions of the more complex phenomena of intelligence into simpler ones, and these again into still simpler ones, have at length brought us down to the simplest; which we find to be nothing else than a change in the state of consciousness. This is the ultimate element out of which alone are built the most involved cognitions. Difficult as it seems to realize the fact, yet analysis leaves us no alternative but to hold that the perception of a vast landscape consists in a multitude of co-ordinated changes; and that of co-ordinated changes also, consists the most abstract conception of the philosopher.

This result, reached by taking to pieces our cognitions, is, indeed, the one indicated by *à priori* considerations. To be conscious is to think; to think is to form conceptions—to put together impressions and ideas; and to do this, is to be the subject of internal changes. It is admitted on all hands that without change, consciousness is impossible. A uniform state of consciousness is in reality no consciousness. When the changes in consciousness cease, consciousness ceases. If then, incessant change is the very condition on which only consciousness can continue, it would seem necessarily to follow that the various phenomena of consciousness are all resolvable into changes; that changes are the constituent elements of every thought; that every intuition, every conception, every conclusion, is made up of changes arranged in a particular manner, and is decomposable into changes. So that even from a general view of the facts, may be prophesied the issue to which a detailed analysis has led us.

Still more clearly may this same issue be foreseen, when it is remembered that we cannot become conscious save through the changes produced in us by surrounding things. Here is an organism placed in the midst of objects. If it is totally uninfluenced by them, it can know nothing of them, think nothing of them. The only way in which it can be rendered cognizant of their existence, is by the effects they produce on it—the changes they work in it; and then it can proximately know nothing but these changes. Only through changes can it be made conscious of objects; and only out of changes can be constructed its knowledge of them.

However we regard the facts, therefore, we see that they confirm the conclusion come to, that the primordial element of all intelligence is simply a change; and that every complex mental phenomenon is a co-ordinated group of changes. But a complete realization of this truth will best be gained by arranging synthetically a few of the results lately reached by analysis. By contemplating in their order of genesis, a few of the primitive cognitions treated of in recent chapters, both the particular conclusions there reached, and the general conclusion based upon them, will be clearly understood.

§ 100. As already sufficiently explained, a continuous or homogeneous state of consciousness is an impossibility—is a no-consciousness. A being that is totally quiescent, that is undergoing absolutely no change, is dead: and a consciousness that has become stationary is a consciousness that has ceased. To constitute a consciousness, however, incessant change is not the sole thing needed. That sentient something whose affections we call consciousness, may readily be conceived as the subject of perpetual and infinitely varied changes, without anything like consciousness, in our sense of the word, being evolved. If the changes are altogether at random—if sensations of different kinds and intensities succeed one another in entire disorder; no consciousness, properly so called, can exist. Con-

sciousness is not simply a succession of changes, but an *orderly* succession of changes—a succession of changes *combined and arranged* in special ways. The changes form the raw material of consciousness; and the development of consciousness is the *organization* of them. This premised, let us consider under what conditions consciousness becomes nascent.

The lowest form of consciousness that can be conceived, is that resulting from the alternation of two states. While some state A, of the sentient subject, persists, there is no consciousness. While some other state B, persists, there is no consciousness. But when there is a change from state A to state B, or from state B to state A, the change itself constitutes a phenomenon in consciousness, that is—a consciousness. Not that such a consciousness is one which we can in any sense realize to ourselves; or one which would in ordinary language be termed consciousness. We must regard it simply as the first step towards the evolution of a consciousness, properly so called—a step such as we may imagine to have been taken in the lowest animals that manifest sensibility. But now let us inquire what is given in this first step. By the hypothesis, the second state B differs from the first state A—constitutes a second state only in virtue of being different; that is to say, A and B are *unlike*. Not that there can yet, or for a long time to come, exist any cognition of them as unlike. Such a cognition implies a complicated mental act, that becomes possible only after a considerable development. All which it now concerns us to note, is, that this first phenomenon is one of the experiences out of which are ultimately elaborated the ideas of *change*, of *sequence*, of *unlikeness*. Suppose now that there occurs the change B to A. Here are the materials for a second relation of sequence—a second relation of unlikeness. But this is not all. There has now arisen a second state A, *like* the first state A. Data have been presented, which, in an advanced consciousness, would constitute a relation of *likeness*. At present, however, even supposing a latent capacity for thinking such a relation, it

cannot be thought, from lack of experiences to class it with. Let there now occur another change, A to B. This constitutes a second relation of unlikeness, of the same nature as the one first established—a change or relation *like* the before-experienced relation. There are now given the materials which, did there exist a power of co-ordinating them, might compose a thought. There have arisen two relations of likeness between primitive states of consciousness, or sensations—between A and A, and between B and B; and also a relation of likeness between two changes—between two relations of unlikeness. By a practised consciousness, this second change or relation would be thinkable as like the first—might be classified with it, or assimilated to it. Let another change B to A arise. A further relation of unlikeness becomes known as like a foregoing one. And by a perpetual repetition of these changes A—B, B—A, the two states and their two relations tend to become more and more cognizable. Thus, even in a consciousness of the lowest imaginable type, there are foreshadowed the relation of sequence, the relation of unlikeness among the sensations, the relation of likeness among the sensations, the relation of unlikeness among the changes, and the relation of likeness among the changes. The earliest possible experiences are those supplying the raw material from which these cognitions are developed.

Suppose now that a third species of state, C—a third order of sensation, is joined to the others. Further relations of likeness and unlikeness between states and between changes, are the consequence. But it is not simply that there can occur a greater variety of phenomena of the same kind: new kinds of phenomena become possible. The two states A, B, we have assumed to alternate with equal facility in each direction A—B, B—A. If however the new state C, frequently follows B, but never precedes it; there results an experience of two orders of change, which become known by mutual contrast: the duplex change A—B, B—A, answering to the relation of co-existence;

and the single change B—C, answering to the relation of sequence proper. Moreover, instead of there being, as at first, no possibility beyond that of perpetual alternation between two states, the introduction of a third state not only renders several combinations possible, but it becomes possible for some particular combination to be established as one of more frequent recurrence than the others; and the recurrence of such particular combination, B—A—C for example, supplies the material for a relation of likeness, not between one single change in consciousness and previous changes, but between a group of changes and previous groups. And yet further, the more varied experiences that now arise of the relations of likeness and unlikeness, which subsist between several kinds of primitive states, several kinds of single changes, and several kinds of compound changes, afford data for the consciousness of likeness and unlikeness in general, apart from the particular terms between which they were first established.

Supposing this introduction of new sensations, new changes, and new combinations among them, to be carried on, step by step; let us mark what must result from that universal law of all mental changes, that the more frequently they have occurred in a certain order, the more easily and rapidly do they follow one another in that order. In proportion as the specially-combined changes D—B—A—C, have been repeated, in the same proportion does the time occupied in the transition from the first to the last become abbreviated; and ultimately, the result is, that this succession of changes takes little or no more time than one of the constituent changes originally did. One consequence of this is, that these compound changes tend to become more and more clearly thinkable as single phenomena in consciousness—more and more readily classable with the like previous phenomena, and distinguishable from others. But now observe further, the important fact, that in proportion as a chain of such changes is consolidated into a single change, *in the same proportion do the several sensations which form the antecedents and consequents*

of the changes, become present to consciousness together. When the compound change D—B—A—C, takes place, as it ultimately does, almost instantaneously, it results that before the first sensation or idea D, has ceased, the others B, A, C, have severally arisen. Hence there is produced a consolidated consciousness, in which many sensations appear to be simultaneously presented—a consolidated consciousness which answers to some outward object that habitually gives this group of sensations. And we have but to conceive an endless progress in this consolidation of changes, to comprehend how there can arise the consciousness of complex things—how the objects with which human intelligence deals become thinkable as like and unlike—how the highest acts of perception and reason become possible.

§ 101. Of course the actual genesis of intelligence is incomparably more complex than it is here represented to be. This description is intended simply to shadow forth the nature of the process—to exhibit the fundamental principles of it. The successive complications above suggested in rapid succession, cannot in reality arise save by insensible degrees. Each order of experiences must be organized by long-continued habit, before any higher order can be dealt with. Each constantly-united group of states of consciousness, must be more or less completely fused into one state, before any further complexity can be reached by the combination of such groups. In respect of its progress, this organization of experiences must conform to the laws of organization in general; and must therefore be extremely slow.

Taking the above description, however, simply as exhibiting the *method* of the process in its most general outlines, it will serve to show that at the very outset, in the very first phenomena of a nascent consciousness, there are involved the materials of those fundamental relations to which analysis has, from the very beginning, pointed. It will serve to make

more comprehensible, how, out of change, kind of change, degree of change, facility of change, arrangement of change, &c., the infinitely varied states of consciousness may be elaborated. And it will serve to suggest how, by the ever-progressing consolidation of changes — the running together of larger and larger groups and series of them—there can arise, out of a linear succession of internal phenomena, the means of representing those extremely complicated phenomena of coexistence which constitute the external world.

CHAPTER XXVI.

RESULTS.

§ 102. Among the general truths to be gathered from the foregoing chapters, considered in their ensemble, one of the most significant, is, that there exists a *unity of composition* throughout all the phenomena of intelligence. We saw at the outset, that the most complex processes of reasoning are resolvable into intuitions of likeness and unlikeness between terms more or less involved. We saw that under various modes, forms, complications and degrees of perfection, these intuitions are traceable not only throughout every species of reasoning, but throughout every species of perception; forming in all cases the general substance of the cognition, whatever its particular modifications. And we have recently seen, both analytically and synthetically, that these intuitions are foreshadowed in the very first steps of an incipient consciousness—that the very earliest and simplest experiences are those which furnish the raw material of these intuitions.

Standing even alone, this consistency in its particular results and their subordination to one general result, supply strong confirmation of the analysis; both as a whole, and in its several parts. But it will be seen to supply yet stronger confirmation, if we reflect that it is inferable, even *à priori*, that analysis must disclose some such universal law. For if there are, as there must be, certain conditions under which alone consciousness can exist, those conditions must be common to all forms, modes, and degrees of consciousness. They must be disclosed along with the initial phenomena of consciousness; and must underlie each of the more complex phenomena built out of these initial phenomena. In other words:—there must

be some *form of thought*, exhibited alike in the very lowest and the very highest manifestations of intelligence—a form which must therefore be traceable in a nascent consciousness. Hence, when we find, as we do, that simultaneously with the first changes by which consciousness begins, there are of necessity given, data for the relations of likeness and unlikeness—that these relations form but another side of the very changes which constitute consciousness; we may conclude that these relations must be the foundation of our entire intelligence. And this being the conclusion reached at every successive stage of an analysis pursued quite independently of any such *à priori* consideration, there cannot be a doubt that the conclusion is correct.

The various divisions, therefore, which we ordinarily make among our mental operations, and which psychologists have mostly sought to explain and establish, as marking out distinct faculties, have merely a superficial truth. They are to be understood as indicating modifications of detail which distinguish phenomena that are essentially similar—modifications which do but mask that fundamental unity of composition possessed by all cognitions whatever.

§ 103. Contemplating the facts from another point of view, we may see that not only the *form* of thought, but the *process* of thought, is the same throughout. Not only is it that the mode in which the elements of a compound quantitative argument are dealt with by the mind, is essentially similar to the mode in which the elements of every other human thought are dealt with; but it is, that the impressions received by inferior intelligences, even down to the very lowest, are dealt with after a like fashion.

We saw that all reasoning is definable as the classification of relations. We saw that the perception of an object, is possible only by the classing of a present group of attributes and relations with a past group. We saw that the constituents of any

complex perception, must be severally classed with previously known constituents of the same order, before the perception in its totality can arise. And we saw that not even the simplest attribute or relation can be known, until there exist others with which it can be ranged; seeing that the knowing it, is the thinking of it as one with certain others—the classing it with those others. Nay, the relation of unlikeness itself, is cognizable only as like previously experienced relations of unlikeness—is incognizable unless there exist other relations with which it may be classed. But as above hinted, this law applies not to human thought alone: it applies to all processes of intelligence whatever; using the word in its most extended sense. The life of the lowest sentient being is made possible only by an organic classification of impressions. The condition on which every creature exists, is, that it shall act in special ways under special stimuli—that contact with nutritive matter shall modify its actions in a manner different from that in which contact with innutritive matter modifies them—that one impression shall lead it to attack, another to hide, and so on. Manifestly, if there is an entire absence of adaptation between its acts and surrounding circumstances, it must quickly cease to live. And if it exhibits any adaptation, it can do so only in virtue of the fact, that certain impressions made upon it call forth one kind of action, while others call forth another kind. There must exist in the organism some means whereby these impressions are distinguished as such or such, or are classified—some organic registry of external differences and similarities. Not, of course, that there is any consciousness of external differences and similarities; but that there is, in the organism, an innate capability of acting thus, or thus, according to the nature of the stimulus; and that in so far, the organism has a power of appreciating differences and similarities—a power of automatic classification.

Hence it becomes clear that the law is the same throughout. When regarded under its fundamental aspect, not only is the highest reasoning seen to be one with all the lower forms of human thought; but it is seen to come under the same gene-

ralization with instinct and reflex action, even in their simplest manifestations. The universal process of intelligence is the *assimilation* of impressions. And the differences displayed in the ascending grades of intelligence are consequent solely upon the increasing complexity of the impressions assimilated.

§ 104. A yet further change in our stand-point, will introduce us to a still more complete view of mental phenomena—will in fact disclose an exhaustive definition of them, whether considered separately or in their totality.

We have seen that the condition on which only consciousness can begin to exist, is the occurrence of a change of state; and that this change of state necessarily generates the terms of a relation of unlikeness. We have seen that not simply does consciousness become nascent only by virtue of a change—by the occurrence of a state unlike the previous state; but that consciousness can continue only so long as changes continue—only so long as relations of unlikeness are being established. Hence then, consciousness can neither arise nor be maintained without the occurrence of differences in its state. It must be ever passing from some one state into a different state. In other words—there must be *a continuous differentiation* of its states.

But we have also seen that the states of consciousness successively arising, can become elements of thought, only by being known as like certain before-experienced states. If no note be taken of the different states as they occur—if they pass through consciousness simply as images pass over a mirror; there can be no intelligence, however long the process be continued. Intelligence can arise only by the organization, by the arrangement, by the classification of these states. If they are severally taken note of, it can only be as more or less like certain previous ones. They are thinkable only as such or such; that is, as like such or such before-experienced states. The act of knowing them is impossible except by classing them with others of the same nature—assimilating them to those

others. Hence then, in being known, each state must become one with certain previous states — must be integrated with those previous states. Each successive act of knowing must be an act of integrating. That is to say, there must be *a continuous integration* of states of consciousness.

These, then, are the two antagonist processes by which consciousness subsists—the centrifugal and centripetal actions by which its balance is maintained. That there may be the material for thought, consciousness must every moment have its state differentiated. And for the new state hence resulting to become a thought, it must be integrated with before-experienced states. This perpetual alternation is the characteristic of all consciousness from the very lowest to the very highest. It is distinctly typified in that oscillation between two states, constituting the simplest conceivable form of consciousness; and it is illustrated in the most complex thinkings of the advanced man of science.

Nor is it only in every passing process of thought that this law is displayed: it is traceable also in the general progress of thought. These minor differentiations and integrations that are going on from moment to moment, result in those greater differentiations and integrations which constitute mental development. Every case in which an advancing intelligence distinguishes between objects, or phenomena, or laws, that were previously confounded together as of like kind, implies a differentiation of states of consciousness. And every case in which such advancing intelligence recognizes, as of the same essential nature, objects, or phenomena, or laws, that were previously thought distinct, implies an integration of states of consciousness.

Under its most general aspect therefore, all mental action whatever is definable as *the continuous differentiation and integration of states of consciousness.*

§ 105. The only further fact of importance here needing to be pointed out, is, the harmony which subsists between this

final result and that reached by a kindred science. The widest truth disclosed by the inquiries of physiologists, is parallel to the one at which we have just arrived.

As there are two antagonist processes by which consciousness is maintained, so there are two antagonist processes by which bodily life is maintained: and the same two antagonist processes are common to both. By the action of oxygen every tissue is being differentiated; and every tissue is integrating the materials supplied by the blood. No function can be performed without the differentiation of the tissue performing it; and no tissue is enabled to perform its function save by the integration of nutriment. In the balance of these two actions the organic life consists. By each new integration, an organ is fitted for being again differentiated: each new differentiation enables the organ again to integrate. And as with the psychical life, so with the physical—the stopping of either process is the stopping of both.

Moreover the parallel equally holds under the second aspect. Not only does this law apply to the vital processes going on throughout the body from moment to moment; it also applies to organic progress in general. Commencing, as every organism does, as a uniform mass of matter, every step in its evolution consists in the differentiation and integration of parts. On contemplating the phenomena of organization in general, as exhibited throughout creation, it will be seen that the integration of elements which perform the same function, goes on *pari passu* with the differentiation of elements which perform unlike functions. That advance from homogeneity to heterogeneity, in which all organization consists, is wholly effected by this duplex action.

Thus, in two senses, there is a continuous differentiation and integration of tissues; as, in two senses, there is a continuous differentiation and integration of states of consciousness.

When it is remembered that the laws of structure and function must necessarily harmonize; and that the structure and functions of the nervous system must conform to the laws of

structure and function in general; it will be seen that the parallelism here roughly indicated, is such as might be expected to hold. It will be seen that the ultimate generalizations of Psychology and Physiology, must be, as they here appear, different sides of the same primordial truth. It will be seen that they are both expressions of the same fundamental principle of Life.

PART III.

GENERAL SYNTHESIS.

CHAPTER I.

METHOD.

§ 106. It is a dominant characteristic of Intelligence, viewed in its successive stages of evolution, that its processes, which, as originally performed, were not accompanied with a consciousness of the manner in which they were performed, or of their adaptation to the ends achieved, become eventually both conscious and systematic. Not simply is this seen on comparing the actions popularly distinguished as instinctive and rational; but it is seen on comparing the successive phases of rationality itself. Thus, children reason, but do not know it. Youths know empirically what reason is, and when they are reasoning. Cultivated adults reason intentionally, with a view to certain results. The more advanced of such presently inquire after what manner they reason. And finally, a few reach a state in which they consciously conform their reasonings to those logical principles which analysis discloses. Clearly to exhibit this law of mental progress, and to show the extent of its application, sundry illustrations may be cited.

Classification supplies us with one. All intelligent action presupposes a grouping together of things possessing like properties. To know what is eatable and what not; which creatures to pursue and which to fly; what materials are fit for these purposes and what for those; alike imply the arrangement of objects into classes of such nature, that from certain sensible characteristics of each, certain other characteristics are foreseen. It is manifest that throughout all life, brute and human, more or less of this discrimination is exercised; that it is more exercised by higher creatures than by lower; and that successful action is in part dependent on the extent to which it is pushed. Now it needs but to open a work on Chemistry, Mineralogy, Botany, or Zoology, to see how this classification

which the child, the savage, and the peasant, carry on spontaneously, and without thinking what they are doing, is carried on by men of science systematically, knowingly, and with deliberate purpose. It needs but to watch their respective proceedings, to see that the degrees of likeness and unlikeness, which unconsciously guide the ignorant in forming classes and subclasses, are consciously used by the cultured to the same end. And it needs but to contrast the less advanced men of science with the more advanced, to see that this process of making groups, which the first pursue with but little perception of its ultimate use, is pursued by the last with clear ideas of its value as a means of achieving higher objects.

So too is it with nomenclatures. Few will hesitate to admit that in the first stages of language, things were named incidentally—not from a recognition of the value of names as facilitating communication; but under the pressure of particular ideas which it was desired to convey. The poverty of aboriginal tongues, which contain words only for the commonest and most conspicuous objects, serves of itself to show, that systems of verbal signs were, in the beginning, unconsciously extended as far only as necessity impelled. Now, however, nomenclatures are made intentionally. A new star, a new island, a new mineral, a new plant or animal, are severally named by their discoverers as soon as found; and are so named with more or less comprehension of the purpose which names subserve. Moreover it may be remarked that whereas, in the primitive unconscious process of naming, the symbols employed were, as far as might be, descriptive of the things signified; so, in our artificial systems of names—and especially in our chemical one — a descriptive character has been designedly given. Add to which, that whereas there spontaneously grew up in natural nomenclatures, certain habitual ways of combining and inflecting names to indicate composite and modified objects; so, in the nomenclatures of science, systematic modes of forming compound names have been consciously adopted.

Again, a similar progress may be traced in the making of

inductions. As is now commonly acknowledged, all general truths are either immediately or mediately inductive—are either themselves derived from aggregations of observed facts, or are deduced from truths that are so derived. The grouping together of the like coexistences and sequences presented by experience, and the formation of a belief that future coexistences and sequences will resemble past ones, is the common type of all initial inferences, whether they be those of the infant or the philosopher. Up to the time of the Greeks, mankind had pursued this process of forming conclusions, unknowingly, as the mass of them pursue it still. Aristotle recognized the fact that certain classes of conclusions were thus formed; and to some extent taught the necessity of so forming them. But it was not until Bacon lived, that the generalization of experiences was erected into a method. Now, however, that all educated men are in a sense Bacon's disciples, we may daily see followed out systematically, and with design, in the investigations of science, those same mental operations which mankind at large have all along unwittingly gone through, in gaining their commonest knowledge of surrounding things. And further, in the valuable "System of Logic" of John Mill, we have now exhibited to us in an organized form, those more complex intellectual proeedures which acute thinkers have ever employed, to some extent, in verifying the aboriginal inductive process—procedures which the most advanced inquirers are now beginning to employ with premeditation, and with a recognition of their nature and their purpose.

Another illustration may be drawn from the first part of this work. On reconsidering the chapter treating of the Universal Postulate, it will be seen that the canon of belief there enunciated as the one to be used in testing every premiss, every step in an argument, every conclusion, is one which men have from the beginning used to these ends; that beliefs which are proved by the inconceivableness of their negations to invariably exist, men have, of necessity, always held to be true, though they have not knowingly done this; and that the step

remaining to be taken, was simply to apply this test consciously and systematically. It will also be seen that the like may be said of the second canon of belief contained in that chapter; viz. that the certainty of any conclusion is great, in proportion as the assumptions of the Universal Postulate made in reaching it are few. For as was pointed out (§ 8), people in general habitually show but little confidence in results reached by elaborate calculations, or by long chains of reasoning; whilst they habitually show the greatest confidence in results reached by direct perception; and these contrasted classes of results are those which respectively presuppose very many and very few assumptions of the Universal Postulate. In this case therefore, as in the other, the rational criterion is simply the popular criterion analyzed, systematized, and applied with premeditation.

In further exemplification of this law I might enlarge upon the fact, that having found habit to generate facility, we intentionally habituate ourselves to those acts in which facility is desired; upon the fact, that having seen how the mind masters its problems by proceeding from the simple to the complex, we now consciously pursue our scientific inquiries in the same order; upon the fact, that having, in our social operations, spontaneously fallen into division of labour, we now, in any new undertaking, introduce division of labour intentionally. But without multiplying illustrations, it will by this time be sufficiently clear, that, as above said, not only between the so-called instinctive processes and rational ones, is there a difference in respect of the consciousness with which they are performed, but there are analogous differences between the successive gradations of rationality itself.

§ 107. Are we not here then, led to a general doctrine of methods? In each of the cases cited, we see an arranged course of action deliberately pursued with a view to special ends—a method; and on inquiring how one of these methods differs from any conscious intelligent procedure not dignified by the

title, we find that it differs only in length and complication. Neglecting this distinction as a merely conventional one—ceasing to regard methods objectively, as written down in books, and regarding them subjectively, as elaborate modes of operation by which the mind reaches certain results—we shall see that they may properly be considered as the highest self-conscious manifestations of the rational faculty. And if, viewed analytically, all methods are simply complex intellectual processes, standing towards conscious reasoning much as conscious reasoning stands towards unconscious reasoning, and as unconscious reasoning stands towards processes lower in the scale — if further, in the several instances above given, methods arose by the systematization and deliberate carrying out of mental operations which were before irregularly and unwittingly pursued—may we not fairly infer that all methods arise after this manner? That they become methods, when the processes they embody have been so frequently repeated as to assume an organized form? And that it is the frequent repetition, which serves alike to give them definiteness, and to attract consciousness to them as processes by which certain ends have been achieved. Is it not indeed obvious, *à priori*, that no method can be practicable to the intellect save one which harmonizes with its pre-established modes of action? Is it not obvious that the conception of a method by its promulgator implies in the experiences of his own mind, cases in which he has successfully followed such method? Is it not obvious that the advance he makes, consists in observing the processes through which his mind passed on those occasions, and generalizing and arranging them into a system? And is it not then obvious that, both in respect of origin and applicability, no method is possible but such as consists of an orderly and habitual use of the procedures which the intellect spontaneously pursues, but pursues fitfully, incompletely, and unconsciously? The answers can scarcely be doubtful.

By thus carrying consciousness a stage higher, and recognizing the method by which methods are evolved, we may

perhaps see our way to further devices in aid of scientific inquiry. As in the case of deductive logic, and classification, and nomenclature, and induction, and the rest, it happened that by becoming conscious of the mode in which the mind wrought in these directions, men were enabled to organize its workings, and consequently to reach results previously unattainable; so, it is possible that by becoming conscious of the method by which methods are formed, we may be assisted in our search after further methods. If in the instances given, the method of forming methods was that of observing the operations by which from time to time the mind spontaneously achieved its ends, and arranging these into a general scheme of action to be constantly followed in analogous cases; then, in whatever directions our modes of inquiry are at present unmethodized, our policy must be to trace the steps by which success is occasionally achieved in these directions; in the hope that by so doing, we may be enabled to frame systems of procedure which shall render future successes more or less sure. That there is scope for this cannot be doubted. On remembering how much, even of the best thinking, is done in an irregular way; how little of the whole chain of thought by which a discovery is made, is included in the bare logical processes; and how unorganized is the part not so included; it will be manifest that there are intellectual operations still remaining to be methodized. And here may fitly be introduced an example, to which, in fact, the foregoing considerations are in a manner introductory.

§ 108. Every generalization is at first an hypothesis. In seeking out the law of any class of phenomena, it is needful to make assumptions respecting it, and then to gather evidence to prove the truth or untruth of the assumptions. The most rigorous adherent of the inductive method, cannot dispense with such assumptions; seeing that without them, he can neither know what facts to look for, nor how to interrogate such facts as he may have. Hypotheses, then, being the indispensable stepping-stones to generalizations—every generalization having

to pass through the hypothetic stage—it becomes a question whether there exists any mode of guiding ourselves towards true hypotheses. At present, hypotheses are chosen unsystematically—are suggested by cursory inspections of the phenomena; and the seizing of right ones, seems, in the great majority of cases, a matter of accident. May we not infer however, from the peculiar skill which some men have displayed in the selection of true hypotheses, that there is a special kind of intellectual action by which they are distinguishable. To call the faculty shown by such men, genius, or intuition, is merely to elude the question. If mental phenomena conform to fixed laws, then, an unusual skill in choosing true hypotheses, means nothing else than an unusual tendency to pursue that mental process by which true hypotheses are reached; and this implies that such a process exists.

To identify this process is the problem: to find how, when seeking the law of any group of phenomena, we may make a probable assumption respecting them—how we may guide ourselves to a point of view from which the facts to be generalized can be seen in their fundamental relations. Evidently, as the thing wanted is always an unknown thing, the only possible guidance must be that arising from a foreknowledge of whereabouts it is to be found, or of its general aspect, or of both. If all true generalizations (excluding the merely empirical ones) should possess a peculiarity in common; and this peculiarity should be one not difficult of recognition; the desired guidance may be had. That such a peculiarity exists, will by this time have been inferred; and it now remains to inquire what it is.

§ 109. Most are familiar with the observation, that viewed in one of its chief aspects, scientific progress is constantly towards larger and larger generalizations—towards generalizations, that is, which include the generalizations previously established. Further, the remark has been made, that every true generalization commonly affords an explanation of some other series of facts than the series out of the investigation of which it originated. In

both of which propositions we have partial statements of the truth, that each onward step in science is achieved when a group of phenomena to be generalized is brought under the same generalization with some connate group previously considered separate. Let us look at a few cases.

In the Calculus it was thus, when the relationships of extension, linear, superficial, and solid, were found to conform to the same law with those of numbers that are multiplied into each other; and again, when numbers themselves, whether representing spaces, forces, times, objects, or what not, were found to possess certain general properties, capable of being expressed algebraically, which remain the same whatever the magnitudes of the numbers. In Mechanics it was thus, when a formula was discovered which brought the equilibrium of the scales, under the same generalization with the equilibrium of the lever with unequal arms: and again, when the discovery that fluids press equally in all directions, afforded explanations, alike of their uniform tendency towards horizontality, and of their power to support floating bodies. Thus too was it in Astronomy, when the apparently erratic movements of the planets, and the comparatively regular movement of the moon, were explained as both due to similar orbital revolutions; and when the celestial motions, and the falling of rain-drops, were explained as different manifestations of the same force. It was thus in Optics, when the composite nature of light was discovered to be the passive cause of the prismatic spectrum, of the rainbow, and of the colours of objects; in Thermotics, when the expansion of mercury, the rising of smoke, and the boiling of water, were recognized as different manifestations of the same law of expansion by heat; in Acoustics, when the doctrine of undulations was found to apply equally to the phenomena of harmonies, of discords, of pulses, of sympathetic vibrations. Similarly, it was thus in Chemistry, when the burning of coal, the rusting of iron, and the wasting away of starved animals, were generalized as instances of oxidation. It was thus too, when the electro-positive and electro-negative relations of the elements,

were brought in elucidation of their chemical affinities. And once more it was thus, when, by the investigations of Œrsted and Ampère, the phenomena of Electricity and Magnetism were reduced to the same category; and the behaviour of the magnetic needle was assimilated to that of a needle subjected to the influence of artificial electric currents.

Now this circumstance, that a true generalization usually brings within one formula groups of phenomena which at first sight seem unallied, is itself a more or less reliable index of the truth of a generalization. For manifestly, to have found for any series of facts, a law which equally applies to some apparently distinct series, implies that we have laid hold of a truth more general than the truths presented by either series regarded separately—more general than the truths which give the special character to either series. If, in the instances above cited, and in hosts of others, we find that the most general fact displayed by any class of phenomena, is also the most general fact displayed by another class, or by several other classes; then, we may conversely infer, on finding a general fact to be true of several cases in each of two separate classes, that there is considerable probability of its being true of all the cases in each class. Or, to exhibit the proposition in another form:—A peculiarity observed to be common to cases that are widely distinct, is more likely to be a fundamental peculiarity, than one which is observed to be common to cases that are nearly related.

Hence, then, is deducible, a method of guiding ourselves towards true hypotheses. For if a characteristic seen equally in instances usually placed in different categories, is more likely to be a general characteristic than one seen equally in instances belonging to the same category; then, it is obviously our policy, when seeking the most general characteristic of any category, not to compare the instances contained in it with each other, but to compare them with instances contained in some allied category. We must seek out all the categories with which alliance is probable; compare some of the phenomena included in each

with some of the phenomena under investigation; ascertain by each comparison what there is common to both kinds; and then, if there be any characteristic common to both, inquire whether it is common to all the phenomena we are aiming to generalize: in doing which we may with advantage still act out the same principle, by comparing first the cases that are most strongly contrasted. The adoption of this course secures two advantages. Not only must any peculiarity which may be hit upon, as common to phenomena of separate classes, have a greater probability of being a generic peculiarity, than any one of the many peculiarities possessed in common by phenomena of the same class; but further, we shall be more likely to observe *all* that there is in common between diverse phenomena placed side by side, than we shall to observe *all* that there is in common between phenomena so much alike as to be classed together. Fewer hypotheses are possible; all that are possible are likely to be thought of; and of those thought of, each has a much higher chance of being true.

§ 110. And now let us avail ourselves of this method, in searching out a generalization on which to base a synthetic Psychology. We have seen that it is a characteristic of progressive intelligence, eventually to perform consciously, processes which were originally performed unconsciously. We have seen that this truth is illustrated by the creeting into systematic modes of procedure, those higher mental operations which had before been followed irregularly and unconsciously. We have seen that by consciously pursuing this method by which methods are arrived at, there is a probability that further methods may be reached. We have sought by doing this, to find a method of choosing probable hypotheses; and have reached a definite conclusion. Here, leaving these preliminary inquiries, it remains to take advantage of this conclusion in commencing the investigation before us.

CHAPTER II.

CONNEXION OF MIND AND LIFE.

§ 111. The only phenomena to which those of intelligence are allied, are the phenomena of vital activity in its lower forms; and to these their alliance is close. Though we commonly regard mental and bodily life as distinct, it needs only to ascend somewhat above the ordinary point of view, to see that they are but sub-divisions of life in general; and that no line of demarcation can be drawn between them, otherwise than arbitrarily. Doubtless, to those who persist, after the popular fashion, in contemplating only the extreme forms of the two, this assertion will appear as incredible as the assertion that a tree arises by imperceptible changes out of a seed, would appear to one who had seen none of the intermediate stages. But in the absence of prejudice, an examination of the successive links, will produce conviction in the one case as in the other. It is not more certain that from the simple reflex action by which the infant sucks, up to the elaborate reasonings of the adult man, the progress is by daily infinitesimal steps, than it is certain that between the automatic actions of the lowest creatures, and the highest conscious actions of the human race, a series of actions, displayed by the various tribes of the animal kingdom, may be so placed, as to render it impossible to say of any one step in the series—Here intelligence begins. If, from the advanced man of science, pursuing his inquiries with a full understanding of the ratiocinative and inductive processes he employs, we descend to the man of ordinary education, who reasons well and comprehensively, but without knowing how; if, going a grade lower, we analyze the thinkings of the villager, whose highest generalizations are but little wider than those which local events afford data for; if, again, we sink to the infe-

rior human races, who cannot be induced to think, who cannot take in ideas of any complexity, and whose conceptions of number scarcely transcend those of the dog;* if we take next the higher quadrumana, hosts of whose actions are quite as rational as those of school-boys, and whose language, however unintelligible to us, is manifestly more or less intelligible to each other; if, from these, we proceed to domesticated animals, whose power of reasoning is conceded even by those under theological bias,† with the qualification that it is special and not general—a qualification which equally holds between the different grades of human reasoning; if, from the most sagacious quadrupeds, we descend to the less and less sagacious ones, noting as we pass how gradual is the transition to those which exhibit no power of modifying their actions to suit special conditions, and which so prove themselves to be guided by what we call instinct; if, from observing the operation of the higher instincts, in which a complicated combination of motions is produced by a complicated combination of stimuli, we go down to the successively lower ones, in which the applied stimuli and the resulting motions are less and less complex; if, presently, we find ourselves merging into what is technically known as reflex action, in which a single motion follows a single stimulus; if, from the creatures in which this implies the irritation of a nerve and the contraction of a muscle, we descend yet lower, to creatures devoid of nervous and muscular systems, and discover that in these the irritability and the contractility are exhibited by the same tissue, which tissue also fulfils the functions of assimilation, secretion, respiration, and reproduction; and if, finally, we perceive that each of the phases of intelligence here instanced, shades off into the adjacent ones by modifications too numerous to specify, too minute to describe, we shall in some measure realize the fact, that no definite separation can be effected between the phenomena of mind and those of vitality in general. Without here, however, urging anything further in support of this position, and without re-

* See Galton's account of the Damaras. † Dr. Whately for example.

quiring that it shall be admitted, present purposes will be sufficiently served by a recognition of the unquestionable truth, that there is a close relationship between the actions we call mental and the actions we call organic—that these classes of actions are more nearly allied to each other than to any remaining classes.

§ 112. Bodily and mental life being thus divisions of life in general—being related to each other as species of which life in general is the genus—it results from the conclusion reached in the last chapter, that we shall most readily find a true generalization of mental phenomena, by comparing them with the lower vital phenomena, and inquiring what characteristic the two classes have in common. The propriety of this course may be recognized even in the absence of any considerations touching method. Only in some formula which includes all manifestations of intelligence, without exception, can we have a safe and sufficient foundation for a Synthetic Psychology. And saying nothing of the inseparableness of the two orders of vital action, it requires but to consider that the process of making a successful astronomical prediction, differs as widely from that by which the distance of an adjacent body is recognized or the hand moved towards it, as this does from the simple reflex stimulation of a gland—it requires only to consider this, to see that a formula including all manifestations of intelligence, must be one which also includes organic actions. Organic actions, however, and the actions which we class as intelligent, comprehend when taken together all the phenomena of vitality. Hence, then, it follows, that in seeking out a characteristic common to both, we are in fact seeking out the characteristic of vital actions in general—the characteristic by which they are distinguished from non-vital actions. Our point of departure must be an inquiry after that peculiarity displayed alike by all the processes of life.

§ 113. Before proceeding to this inquiry, it may be well to

remark, that any conclusion to which it may lead, must be expected to have very little apparent bearing upon our special topic. The more general is any truth, the more vague it is. The greater the range and the more diverse the character of the phenomena, the less apparent relation will a proposition which is true of them all, have to each. Little connection is visible between the axiom—"Things that are equal to the same thing are equal to one another," and the theorems of Euclid. The law that portions of matter attract each other with a force varying inversely as the square of the distance, does not seem to offer any explanation of the perturbations of Uranus, or the rising of a balloon. Similarly, we may be sure, *à priori*, that a fact predicable equally of all the infinitely varied actions going on in living bodies, must give little obvious promise of explaining the phenomena classed under the title of Psychology; and especially those highly complex phenomena of human intelligence, with which, in the minds of most, that title is associated.

CHAPTER III.

PROXIMATE DEFINITION OF LIFE.

§ 114. The further we carry our analysis of things, the more manifest does it become, that divisions and classifications are essentially human inventions which have no absolute demarcations in nature corresponding to them, but are simply subjective—are scientific artifices by which we limit and arrange the matter under investigation, and so facilitate our thinking. Hence the circumstance, that when we attempt to frame a definition of anything complex, or make a generalization of facts other than the most simple, we can scarcely ever avoid including more than we intended, or leaving out something that should be taken in. Thus it happens that on seeking a definition of Life which shall be fundamental, we have great difficulty in finding one that is neither more nor less than sufficient—one which takes in all the phenomena, and yet takes in no other phenomena than those commonly considered vital. That this fact may be duly realized, it will be well here to look at a few of the most tenable definitions that have been given; more especially as, in recognizing the respects in which the current ones are defective, we shall see what requirements a more complete one must fulfil.

Schelling, and after him, his plagiarist Coleridge, define Life as—the tendency to individuation. This is a formula which, until studied, conveys little meaning. But it needs only to consider it as interpreted by the facts of development, or by the contrasts between the lower and the higher forms of life, to recognize its value, especially in respect of comprehensiveness. It is objectionable, however, partly on the ground that it refers, not so much to the phenomena constituting Life, as to the formation of those peculiar aggregations of matter which

manifest Life; and partly on the ground that it includes under the idea Life, much that we usually exclude from it: as for instance—crystallization.

The definition of Richerand, who says that "Life is a collection of phenomena which succeed each other during a limited time in an organized body," is liable to the fatal criticism, that it equally applies to the phenomena of decay which go on after death. For these too, constitute "a collection of phenomena which succeed each other during a limited time in an organized body."

De Blainville's definition—"Life is the two-fold internal movement of composition and decomposition, at once general and continuous"—is in some respects too narrow, and in other respects too wide. On the one hand, while it very well expresses what physiologists distinguish as vegetative life, it wholly excludes those functions of the nervous and muscular systems which form the most conspicuous and distinctive classes of vital phenomena. On the other hand, it describes not only the integrating and disintegrating processes going on in a living body, but it equally well describes those going on in a galvanic battery; which also exhibits a "two-fold internal movement of composition and decomposition, at once general and continuous."

Elsewhere, I have myself proposed to define Life as—"the co-ordination of actions;"* and I still incline towards this definition as one answering to the facts with tolerable precision. It includes all vital processes, alike of the viscera, the limbs, and the brain. It excludes the great mass of inorganic changes, which display little or no co-ordination. By bringing into view co-ordination as the specific characteristic of vitality, it involves the truths, that an arrest of co-ordination is death, and an imperfection of co-ordination is disease. And further, this making co-ordination the essential peculiarity, thoroughly harmonizes with our ordinary ideas of life in all its different gradations:

* See *Westminster Review* for April, 1852.—Art. IV. "A Theory of Population."

seeing that the organisms which we rank as low, in respect of the life they display, are those which display but little co-ordination of actions; and that from these up to man, the recognized increase in degree of life, corresponds with an increase in the extent and complexity of the co-ordination. But in common with the others, this definition includes too much; for it may be said of the solar system, with its regularly-recurring movements and its self-balancing perturbations, that it, also, exhibits a co-ordination of actions. And however plausibly it may be argued that, in the abstract, the motions of the planets and satellites are as properly comprehended in the idea of life, as the changes going on in a motionless, unsensitive seed; yet, it must be admitted that they are foreign to that idea as commonly received, and as here to be formulated.

It remains to add the definition since suggested by Mr. G. H. Lewes—"Life is a series of definite and successive changes, both of structure and composition, which take place within an individual without destroying its identity." The last fact which this statement has the merit of bringing into view—the persistence of a living organism as a whole, in spite of the continuous destruction and replacement of its parts—is important. But otherwise it may be argued, that as changes of structure and composition, though probably the *causes* of muscular and nervous actions, are not the muscular and nervous actions themselves, the definition excludes the more visible movements with which our idea of life is most associated; and further, that in describing vital changes as *a series*, it scarcely includes the fact, that many of them, as Nutrition, Circulation, Respiration, and Secretion, in their many subdivisions, go on simultaneously.

Thus, however well each of these definitions may express the phenomena of life under one or other of its aspects, no one of them is more than approximately true. It may turn out, that to find one which will bear all tests, is impossible. Meanwhile, it is possible to frame a more adequate formula than any of the foregoing. As we shall presently find, these one and all

omit an essential peculiarity of vital changes in general—a peculiarity which, perhaps, more than any other, distinguishes them from non-vital changes. Before specifying this peculiarity, however, it will be well to trace our way, step by step, to as complete an idea of Life as may be reached from our present stand-point: by doing which, we shall both see the necessity for each limitation as it is made, and ultimately be led to feel the need for a further limitation. And here we shall have occasion to follow out in detail, the before-described method of hypotheses; by taking a phenomenon from each of the two grand divisions of vital action, and considering in what they agree.

§ 115. Choosing assimilation, then, for our example of organic life; and the drawing an inference for our example of that life, known as intelligence; it is first to be observed, that they are both processes of change. Without change, food cannot be taken into the blood or transformed into tissue: without change, there can be no getting from premisses to conclusion. And it is this conspicuous manifestation of change, which forms the substratum of our idea of Life in general. It is true that we witness an infinitude of changes to which we attach no notion of vitality—hourly see in inorganic bodies, change of temperature, change of colour, change of aggregation. But it will be admitted that the great majority of the phenomena displayed by inorganic bodies, are statical and not dynamical; that their changes are mostly slow and unobtrusive; that on the one hand, when we see sudden change in inorganic bodies, we are apt to assume living agency, and on the other hand, when we see no change in organic bodies, are apt to assume death. From all which considerations it is manifest, that be the requisite qualifications what they may, a definition of Life must be a definition of some kind of change or changes.

On a further comparison of assimilation and reasoning, with a view of seeing in what respect the process of change displayed in both, differs from non-vital change, we quickly perceive that it differs in being not simple uniform change, but change made up

of *successive* changes. The transformation of food into tissue, involves mastication, deglutition, chymification, chylification, absorption, and those various actions gone through after the lacteal ducts have poured their contents into the blood. The carrying on a chain of reasoning, necessitates a great number of successive states of consciousness, each implying a change of the preceding state. Inorganic changes, however, do not in any considerable degree exhibit this peculiarity. A crystal grows to a certain size and then remains stationary. Exposure to the air may afterwards cause it to effloresce, to deliquesce, to lose its water of crystallization, or, under solar influence, to manifest a new atomic constitution. But successive alterations of state such as these, are not the rule; they are the exceptions. It is not to be denied, indeed, that from meteorological causes, inorganic bodies are daily, sometimes hourly, undergoing modifications of temperature, of bulk, of hygrometric and electric condition. Not only, however, do these modifications lack that conspicuousness and that rapidity of succession which vital ones possess, but vital ones form an *additional* series. Organic and inorganic bodies are affected in common by meteorological influences, and beyond the changes produced by these, organic bodies exhibit other changes more numerous and more marked. True, therefore, though it is, that organic change cannot be rigorously distinguished from inorganic change by its presenting successive phases—true, though it is, that some inanimate objects, as a watch, display phases of change equally quick and numerous; that there are no objects but what are ever undergoing change of some kind, visible or invisible; and that there are few if any objects which do not, in the lapse of time, undergo a considerable amount of change that is fairly divisible into phases—yet, the change going on in living bodies so greatly exceeds most other change in this respect, that we may consider the varying phases it unceasingly displays, as practically one of its peculiar characteristics. Life, then, as thus roughly differentiated, may be regarded as change presenting successive phases; or otherwise, as a series of changes. And it

should be observed, as a fact serving to bring out this characteristic into greater distinctness, that the higher the life the more conspicuous the variations. On comparing inferior with superior organisms, these last will be seen to display more rapid changes, or a much more lengthened series of them, or both.

Contemplating afresh our two typical phenomena, we may see that vital change is further differentiated from non-vital change, by being made up of many *simultaneous* changes. The process of assimilation does not exhibit simply a series of actions; but it also exhibits many actions going on together. Not only during mastication, is the stomach busy with the food already swallowed, on which it is both pouring out solvent fluids and exercising muscular actions—not only afterwards, while the stomach is still active, are the intestines performing their secretive, contractile, and absorbent functions; but at the same time that one meal is being digested, the nutriment obtained from a previous meal is undergoing that transformation into tissue, which constitutes the final act of assimilation. So also is it, in a certain sense, with mental changes. Though it is true that the states of consciousness which go to make up an argument, occur in series; yet, as each of these successive states is in itself complex—implies the simultaneous excitement of those many faculties by which the perception of any object or relation has been effected; it is obvious that each change in consciousness implies many component changes in the state of the nervous centres. In this respect too, however, it must be admitted that the distinction between animate and inanimate is not precise. No mass of dead matter can have its temperature altered, without at the same time undergoing an alteration in bulk, and sometimes also in hygrometric state. An inorganic body cannot be oxidized, without being at the same time changed in weight, colour, atomic arrangement, temperature, and electric condition. And in some cases, as in that of the sea, the simultaneous as well as the serial changes displayed, are even more numerous than those going on in an animal. Nevertheless, it may still be truly

said, that with but few exceptions, a living object is distinguished from a dead one by the peculiarity that the changes at any moment taking place in it are far more numerous. Add to which, that by this peculiarity, as by the previous one, not only is the vital more or less clearly demarcated from the non-vital; but creatures possessing high vitality are demarcated from those possessing low. It needs but to contrast the many organs co-operating in a mammal, with the few in the comparatively structureless polype, to see that the actions which are progressing together in the body of the first, as much exceed in number the actions progressing together in the body of the last, as these do those in a stone. As at present analyzed, then, Life consists of simultaneous and successive changes.

Resorting, as before, to further comparison, we next find that vital changes, both organic and mental, differ from other changes in their *heterogeneity*. Neither the simultaneous acts nor the serial acts, which together constitute the process of digestion, are at all alike. The states of consciousness comprised in any ratiocination are not similar to each other, either in their composition or in their modes of dependence. Inorganic processes, on the other hand, even when like vital ones in the number of the simultaneous and successive changes they involve, are unlike them in the homogeneity of these changes. For instance, in the case of the sea, just referred to, it is observable that infinite as are the changes at any moment exhibited, they are mostly mechanical changes, to a great degree repetitions of each other: and in this respect, widely differ from the changes at any moment taking place in an organism; which not only belong to the several classes, mechanical, chemical, thermal, electric, but present under each of these classes, innumerable changes differing both in kind and amount. Even where inorganic action most nearly simulates life, as in the working of a steam-engine, we may see that considerable as is the number of simultaneous changes, and rapid as are the successive ones, the regularity with which they shortly recur in the same order and degree, renders them quite unlike those varied

changes exhibited by a living creature. Still, it will be found that this peculiarity, like the foregoing ones, does not divide the two classes of changes with precision; inasmuch as there are inanimate things which exhibit considerable heterogeneity of change: for instance, a cloud. The variations of state which this undergoes, both simultaneous and successive, are not only many and quick; but they differ widely from each other both in quality and quantity. At the same instant there may be taking place in a cloud, change of position, change of form, change of size, change of density, change of colour, change of temperature, change of electric state; and these several kinds of change are continuously displaying themselves in different degrees and combinations. Yet notwithstanding this, it needs but to consider that, on the one hand, very few objects in the inorganic world manifest heterogeneity of change in any marked manner, whilst on the other hand, all organic objects manifest it; and further, that in common with preceding characteristics, this characteristic is manifested with increasing conspicuousness as we progress from low to high forms of life, which last exhibit an incomparably greater variety in the kinds and amounts of their changes—it needs but to consider these facts, to perceive that we have here a further leading distinction between organic and inorganic action. At present, then, we may regard Life as made up of heterogeneous changes both simultaneous and successive.

If now we yet again repeat our comparison, for the purpose of finding out in what respect the assimilative and logical processes are distinguished from those inorganic processes which are most like them in the heterogeneity of the simultaneous and successive changes they comprise, we discover that they are distinguished by the *combination* subsisting among their constituent changes. The acts that go to make up digestion, are mutually dependent: those involved in a train of reasoning possess a close interconnection: and generally, it is to be remarked of vital changes, that each is made possible by all, and all are affected by each. Respiration, circulation, absorption,

secretion, in their many sub-divisions, are indissolubly bound up together. Muscular contraction involves chemical change, change of temperature, and change in the excretions. Active thought influences the operations of the stomach, of the heart, of the kidneys. But we miss this peculiarity in inorganic processes. Life-like as may seem the action of a volcano in respect of the heterogeneity of its many simultaneous and successive changes, it is not life-like in respect of the combination subsisting among them. Though the chemical, mechanical, thermal, and electric phenomena exhibited, have a certain interdependence; yet, the emission of stones, mud, lava, flame, ashes, smoke, steam, takes place with no manifest regularity, either in quantity, order, intervals, or mode of conjunction. Even here, however, it cannot be said that inanimate things present no parallels to animate ones. A glacier may be instanced as showing nearly as much combination in its changes as a plant of the lowest organization. It is in constant growth and constant decay; and the rates of its composition and decomposition preserve a tolerably equable ratio. It moves; and its motion is in immediate dependence on its thawing. It emits a torrent of water, which, in common with its motion, undergoes annual variations as plants do: and both also undergo, in summer at least, daily variations. During part of the year, the surface melts and freezes alternately; and on these changes are dependent the variations in progressive movement, and in efflux of water. Thus we have growth, decay, changes of temperature, changes of consistence, changes of velocity, changes of excretion, all going on in mutual dependence: and it may be almost as truly said of a glacier as of an animal, that by ceaseless integration and disintegration it gradually undergoes an entire change of substance without losing its individuality. Exceptional as is this instance, however, it will scarcely be held to weaken that broad distinction between organic and inorganic processes, which the fact of combination among the constituent changes offers. And the reality of this distinction will be yet further realized, on finding that, in common with pre-

vious ones, it holds not only between the living and the not-living, but also between things which live little and things which live much—a fact which will be duly recognized on remembering that whilst the changes going on in a plant or a zoophyte, are so imperfectly combined that they can continue after it has been divided into two or more pieces, the combination subsisting amongst the changes going on in a mammal, is so close that no part cut off from the rest can live, and any considerable disturbance of one function causes a cessation of the others. Life then, according to our formula as now modified, is a combination of heterogeneous changes both simultaneous and successive.

On once more looking for a distinction, we shall perceive that the combination of heterogeneous changes which constitutes vitality, differs from the few combinations which otherwise resemble it, in respect of its *definiteness*. The combined changes going on in a glacier, admit of indefinite variation. Under a conceivable alteration of climate, its thawing and its progression may be entirely arrested for myriads of years, without destroying its capacity for again displaying these phenomena under appropriate conditions. By a geological convulsion, its motion may be arrested without an arrest of its thawing; or by an increase in the inclination of the surface it moves over, its motion may be accelerated without any acceleration of its rate of dissolution. Other things remaining the same, a more rapid deposit of snow may cause an indefinite increase in bulk; or conversely, the accretion may entirely cease, and yet all the other actions continue until the mass finally disappears. Here then, the combination has none of that definiteness, which, in a plant, marks the mutual dependence of assimilation, respiration, and circulation, or the functions of the roots and the functions of the leaves: much less has it that definiteness seen in the mutual dependence of the chief animal functions; no one of which can be varied without varying the rest; no one of which can go on unless the rest go on. It is this definiteness of combination, which distinguishes

the changes taking place in a living body from those taking place in a dead one. The process of decomposition exhibits both simultaneous and successive changes, which are to some extent heterogeneous, and in a sense combined; but they are not combined in any definite manner. They will go on differently according as the surrounding medium is air, water, or earth. They will vary in nature with the temperature. If the local conditions are unlike, they will progress differently in different parts of the mass, without any mutual influence. They may end in producing gases, or adipocire, or the dry mouldering substance of which mummies consist. They may occupy a few days, or thousands of years. Thus, neither in their simultaneous nor in their successive changes, do dead bodies display that definiteness of combination which characterizes living ones. It is true that in some inferior creatures, the cycle of successive changes admits of a certain indefiniteness — that it may be suspended for a long period by dessication or freezing; and may afterwards go on as though there had been no breach in its continuity. But the circumstance that it is only a low order of life which permits the cycle of its changes to be thus modified, serves but to suggest that, like the previous characteristics, this characteristic of definiteness in its combined changes, distinguishes high vitality from low vitality, as it distinguishes low vitality from inorganic processes. Hence, our formula as further amended reads thus:—Life is a definite combination of heterogeneous changes, both simultaneous and successive.

Finally it remains only to observe, that we shall still better express the facts, if, instead of saying *a* definite combination of heterogeneous changes, we say *the* definite combination of heterogeneous changes. As it at present stands, the definition is defective not only in allowing that there may be *other* definite combinations of heterogeneous changes, which it should not do; but it has the further defect of directing the attention to the heterogeneous changes as the essential thing, rather than to the definiteness of their combination. Just as it is not so much its chemical elements which constitute an organism, as it

is the arrangement of them into special tissues and organs; so it is not so much its heterogeneous changes which constitute life, as it is the definite combination of them. To gain a clear perception of this fact, it needs but to consider what it is that ceases when life ceases. In a dead body there are going on heterogeneous changes, both simultaneous and successive. What then has disappeared? The definite combination has disappeared. Add to which that our common idea of life, turns more upon this member of the definition than upon the others: seeing that however heterogeneous may be the simultaneous and successive changes exhibited by an inorganic object, as a volcano, we much less tend to associate with it the idea of life, than we do with a watch or a steam engine, which, though displaying homogeneous changes, displays them definitely combined. And so dominant an element in our idea of life, is this definite combination, that even when an object is motionless, yet, if its parts be definitely combined, we conclude either that it has had life, or has been made by something having life. In its ultimate shape therefore, we read as our definition of Life—*the* definite combination of heterogeneous changes, both simultaneous and successive.

§ 116. Such is the conception at which we arrive without changing our stand-point. It is, however, an incomplete conception. This ultimate formula—which it may be observed in passing, is to a considerable extent identical with one above given — "the co-ordination of actions:" seeing that "definite combination" is synonymous with "co-ordination," and "changes both simultaneous and successive" are comprehended under the term "actions;" but which differs from it in specifying the important fact, that the actions or changes are "heterogeneous"—this ultimate formula, I say, is after all but proximately correct. It is true that it does not fail by including the growth of a crystal; for the successive changes this implies cannot be called heterogeneous. It is true that the action of a galvanic battery is not comprised in it; seeing

that here, too, heterogeneity is not exhibited by the successive changes. It is true that by this same qualification the motions of the solar system are excluded: as are also those of a watch and a steam engine. It is true, moreover, that whilst, in virtue of their heterogeneity, the actions going on in a cloud, in a volcano, in a glacier, fulfil the definition; they fall short of it in lacking definiteness of combination. It is further true that this definiteness of combination, distinguishes the changes taking place in an organism during life, from those which commence at death. And beyond all this it is true, that each member of the definition serves not simply to distinguish, more or less markedly, organic actions from inorganic actions, but also serves to distinguish the actions constituting high vitality from those constituting low vitality: seeing that life is high in proportion to the number of successive changes occurring between birth and death; in proportion to the number of simultaneous changes; in proportion to the heterogeneity of the changes; in proportion to the combination subsisting among the changes; and in proportion to the definiteness of their combination. Nevertheless, answering though it does to so many requirements, this definition is essentially defective. However satisfactorily it may separate from the class of vital actions, the actions which simulate them—however it may thus fulfil the literal requirements of a definition—it does not fulfil the essential one. It does not convey to the mind a complete idea of the thing described. *The definite combination of heterogeneous changes, both simultaneous and successive,* is a formula which fails to call up an adequate conception. And it fails from omitting the most distinctive peculiarity—the peculiarity of which we have the most familiar experience, and with which our notion of life is, more than with any other, associated. It remains now to supplement the definition by the addition of this peculiarity.

CHAPTER IV.

THE CORRESPONDENCE BETWEEN LIFE AND ITS CIRCUMSTANCES.

§ 117. On considering after what manner we habitually distinguish between a live object and a dead one, we shall find that we do so by observing whether a change which we make in the surrounding conditions, or one which Nature makes in them, is or is not followed by some perceptible change in the object. By discovering that certain things shrink when touched, or fly away when approached, or start when a noise is made, the child first roughly discriminates between the living and the not living; and the man when in doubt whether an animal he is looking at is dead or not, stirs it with his stick; or if it be at a distance, shouts, or throws a stone at it. Vegetable and animal life are alike primarily recognized by this process. The tree that puts out leaves when the spring brings a change of temperature; the flower which opens and closes with the rising and setting of the sun; the plant that droops when the soil is dry, and re-erects itself when watered; are considered alive in virtue of these induced changes: in common with the zoophyte which contracts on the passing of a cloud over the sun; the worm that comes out on to the surface when the ground is continuously shaken; and the hedgehog that rolls itself up when attacked.

Not only, however, do we habitually look for some response when an external stimulus is applied to a living organism, but we recognize a certain fitness in the response. Dead as well as living things display changes under certain changes of condition: as a lump of carbonate of soda that effervesces when dropped into sulphuric acid; as a cord that contracts when wetted; as a piece of wood that turns brown when held to the fire. But in these cases, we do not perceive any connection

between the changes undergone, and the preservation of the things that undergo them; or, to avoid any teleological implication—the changes have no apparent relation to future external events which are sure or likely to take place. In vital changes, however, such a relation is clearly visible. Light being a necessary of vegetable life, we see in the action of a plant which, when much shaded, grows towards the unshaded side, an appropriateness which we should not see did it grow otherwise. The proceedings of a spider which rushes out when its web is gently shaken, and stays within when the shaking is violent, manifestly conduce better to the obtainment of food, and the avoidance of danger, than were they reversed. And without multiplying familiar illustrations, the fact that we feel surprise when, as in the case of a bird fascinated by a snake, we see actions tending towards self-destruction, at once shows how generally we have observed a harmony between living changes and changes in surrounding circumstances.

Yet further, there remains to notice the hackneyed truth—the truth rendered so common by infinite repetition that we almost forget its significance — that there is invariably, and necessarily, a certain conformity between the vital functions of any organism, and the conditions in which it is placed—between the processes going on inside of it, and the processes going on outside of it. We know that a fish cannot live in air, or a man in water. An oak growing in the ocean, and a seaweed on the top of a mountain, are incredible combinations of ideas. We find that each animal is limited to a certain range of climate; each plant to certain zones of latitude and elevation. Of the marine flora and fauna, each species is found only between such and such depths. Certain blind creatures can flourish only in dark caves; the limpet only where it is alternately covered and uncovered by the tide; the red-snow fungus only in the arctic regions, or among alpine peaks.

Grouping together these two classes of cases — the cases first named, in which a particular change in the circumstances of an organism is followed by a particular change in it, and the

case last named, in which the constant actions going on inside of an organism are dependent upon some constant actions going on outside of it,—we see that in both, the changes or processes displayed by a living body, are specially related to the changes or processes in its environment. And in this truth we find the needful supplement to our definition. By the addition of this all-important characteristic, Life is defined as—The definite combination of heterogeneous changes, both simultaneous and successive, *in correspondence with external coexistences and sequences*. That the full significance of this addition may be seen, it will be necessary to glance at the correspondence under some of its leading aspects.

§ 118. If we study the actions going on in a plant, with the view of ascertaining what they presuppose, we find that, neglecting minor requirements, there needs a surrounding medium containing at least carbonic acid and water, together with a due supply of light and a certain temperature. Within the leaves, carbon is being assimilated and oxygen given off: without them, is the gas from which the carbon is abstracted, and the imponderable agents by whose aid the abstraction is effected. Be the particular character of the process what it may, it is certain that there are external elements prone to undergo special combination under special conditions: it is certain that the plant presents these conditions and so effects these combinations: and thus it is certain that the several cotemporaneous changes which constitute the plant's life, are in correspondence with coexistences in its environment.

If, again, we ask ourselves respecting the lowest animal cell, what are the changes in virtue of which it continues to live; the answer is, that whilst on the one hand its substance is constantly undergoing oxidation, it is on the other hand constantly absorbing new material from the surrounding medium: and that this organic monad may continue to exist, it is needful that on the average the absorption should go on as fast as, or faster than, the oxidation. If further we ask under what circum-

stances these combined changes are possible; there is the obvious reply, that the medium in which the monad is placed, must contain oxygen and assimilable matter in a certain ratio. The integrating and disintegrating actions, of which, so far as we can ascertain, the life of the cell consists, necessarily presuppose oxygen and food around the cell—the oxygen in such quantity as to produce some disintegration; the food in such quantity as to permit that disintegration to be made good. Or in other words:—the two antagonistic processes taking place internally, must be in correspondence with the two antagonistic elements present externally.

If, again, leaving those lowest animal forms revealed by the microscope, which simply take in through their external surfaces the nutriment and oxygen coming in contact with them, we pass to those somewhat higher and larger forms which possess a digestive cavity—which have their tissue partially specialized into assimilative and respiratory, in adaptation to these two fundamental processes of integration and disintegration—we see in them, a correspondence between certain actions in the digestive sac, and the properties of certain surrounding bodies. That a creature of this order may continue to live, it is, on the one hand, necessary, that there be available substances in the environment capable of transformation into its own tissue; and on the other hand it is necessary that the introduction of these substances into the digestive sac, shall be followed by the secretion of a solvent fluid capable of reducing them into a fit state for absorption.

When, from the process by which food is digested, we turn to the processes by which it is seized, we perceive the same general truth. The stinging and contractile power of a medusa's tentacle, correspond to the sensitiveness and strength of the living creatures serving for prey, amidst which it floats. Unless that external change which ends in bringing a living body in contact with the tentacle, were instantly followed by those internal changes which result in the coiling and drawing up of the tentacle, the medusa would die of inanition: that is, the funda-

mental processes of integration and disintegration within it, would get out of correspondence with the agencies and processes without it, and the life would cease.

Similarly, it might be shown that when the mass of tissue of which the creature consists, becomes so large that it cannot be efficiently supplied with nutriment by mere absorption through its limiting membranes, or duly aërated by the action of the surrounding fluid upon its surface, there arises a necessity for a circulatory system by which nutriment and oxygen may be distributed throughout the mass—a system whose actions, as subsidiary to the two primary actions, form links in the correspondence between internal and external changes. And the like is obviously true of all those subordinate functions, secretory and excretory, by which oxidation and assimilation are facilitated—functions which exhibit not only various cotemporaneous changes in mediate correspondence with coexistences in the environment; but which further exhibit successive changes, corresponding to those changes of composition, of temperature, of light, of moisture, of pressure, which the environment undergoes.

Ascending from the visceral actions constituting what physiologists term vegetative life, to the muscular and nervous actions of which animal life is made up, we find the correspondence displayed in a manner still more obvious. The successful performance of any act of locomotion, implies the expenditure of certain internal mechanical forces, adapted in amount and direction to overcome certain external ones. The recognition of an object, implies a harmony between the changes constituting perception, and the particular colours, size, and form, coexisting in the environment. Escape from enemies, presupposes motions within the organism, related in kind and rapidity to motions without it. Destruction of prey, requires a particular combination of subjective changes fitted in amount and succession to counterbalance a group of objective ones. And so with that infinity of adapted actions exemplified at length in works on animal instincts.

In the highest order of vital processes, the same fact is equally manifest. The empirical generalization that guides the farmer in his rotation of crops, serves to bring his actions into concord with certain of the actions going on around him. The rational deductions by which the educated navigator calculates his position at sea, imply a series of mental acts by which his proceedings are conformed to surrounding circumstances. Alike in the simplest inferences of the child, and the most refined ones of the man of science, we may recognize this same fundamental correspondence between the simultaneous and successive changes in the organism, and the coexistences and sequences in its environment.

§ 119. Before proceeding to develope this general formula, which, as we have seen, comprehends equally the lowest processes of plant-life and the highest manifestations of human intelligence, I must dispose of a few unimportant objections that may be urged against it.

In the first place, there are still a few inorganic actions apparently included within the definition; as for example that displayed by the storm-glass. The feathery crystallization, which, on the approach of atmospheric disturbance, takes place in the solution contained in this instrument—a crystallization said to assume this or that character according to the nature of the impending change, and which afterwards dissolves to reappear in new forms under new conditions—may be held to present simultaneous and successive changes that are to some extent heterogeneous, that occur with some definiteness of combination, and, above all, occur in correspondence with external changes. It must be admitted that in this case vegetable life is simulated to a considerable extent; but it is *merely* simulated. Were there no more conclusive mode of meeting the objection, it might be needful to dwell on the fact, that the simultaneous and successive changes here exhibited, consisting solely of modifications of form and atomic arrangement, are neither so numerous nor so heterogeneous as those going on

in a plant, which is ever undergoing not only structural modifications, but also those modifications constituting assimilation, circulation, and respiration. It might be needful to dwell on the further fact, that though the changes occur with a certain definiteness of combination, yet that the combination is not *so* definite as in the plant, either in respect to the form produced, the time occupied in its production, or the time during which it lasts. And once more it might be requisite to urge, that as, though fulfilling the definition in this imperfect manner, these changes so far resemble vital ones that were it not for the great difference in chemical and other conditions we might confound the two, the definition must not be blamed for seeming to include what seems very much like life. But the proper and conclusive reply is, that the relation between the phenomena occurring in the storm-glass and in the atmosphere respectively, is really not a correspondence at all, in the proper sense of the word. Outside there is a certain change; inside there is a change of atomic arrangement: outside there is another certain change; inside there is another change of atomic arrangement. But subtle as is the dependence of each internal upon each external change, the relation between them does not, in the abstract, differ from the relation between the motion of a straw and the motion of the wind that disturbs it. In either case a change produces a change, and there it ends. As with every inanimate object whose state has been altered by an alteration in the environment, the alteration undergone by the object does not tend to produce in it a secondary alteration, in anticipation of some secondary alteration in the environment. But in every living body there is a tendency towards secondary alterations of this nature: and it is in their production that the correspondence consists. To express the difference by means of symbols:—Let A be a change in the environment; and B some resulting change in an inorganic mass. Then A having produced B, the action ceases. Though the change A in the environment, is followed by some consequent change *a* in it, no parallel sequence in the inorganic mass simultaneously gene-

rates in it some change *b*. But if we take a living organism, and let the change A impress on it some change C; then, whilst in the environment, A is occasioning *a*, in the organism C will be occasioning *c*: of which *a* and *c* will show a certain concord in time, place, or intensity. And whilst on the one hand, it is *in* the continuous production of such concords or correspondences that the life consists; it is on the other, *by* the continuous production of them that the life is made possible.

The further criticisms that may be expected, refer to certain verbal imperfections in the definition, which it seems impossible to avoid. It may be said with truth, that the word *correspondence*, will not include, without straining, the various relations to be expressed by it. It may be asked:—How can the continuous *processes* of assimilation and respiration, correspond with the *coexistence* of food and oxygen in the environment? or again:—How can the act of secreting some defensive fluid, correspond with some external danger which may never occur? or again:—How can the *dynamical* phenomena constituting perception, correspond with the *statical* phenomena of the solid body perceived? The only reply to these questions, is, that we have no word sufficiently general to comprehend all forms of this relation between the organism and its medium, and yet sufficiently specific to convey an adequate idea of the relation; and that the word *correspondence* seems the least objectionable. The fact to be expressed in all cases, is, that certain changes, continuous or discontinuous, in the organism, are connected after such a manner that, in their relative amounts, or variations, or periods of occurrence, or modes of succession, they have a manifest reference to external actions, constant or serial, actual or potential—a reference such that a definite relation amongst any members of the one group, implies a definite relation amongst certain members of the other group; and the word *correspondence* appears the best fitted to express this fact.

§ 120. And here this presentation of the phenomena under the general form of relations, suggests that before closing the

chapter, it will be well to point out how this definition of life may be reduced to its most abstract shape, and its perhaps most perfect shape. By regarding the respective elements of the definition as relations, we may avoid both the circumlocution and the verbal inaccuracy; and that we may so regard them with propriety is obvious. If a creature's rate of respiration is increased in consequence of a decrease of temperature in its environment; it is that the modified relation between the quantity of heat and the quantity of oxygen in the environment, is met by a modified relation between the amount of oxygen absorbed and heat retained, by the creature. If a sound or a scent wafted to it on the breeze, prompts the stag to dart away from the deer-stalker; it is that there exists in its neighbourhood, a relation between a certain sensible property and certain actions dangerous to the stag, while in its organism there exists an adapted relation between the impression that this sensible property produces, and the actions by which danger is escaped. If a long course of inquiry has led the chemist to a law, enabling him to tell how much of any one element will combine with so much of another; it is that the course of inquiry has established in him specific mental relations, which accord with specific chemical relations in the things around. Hence then, as in all cases we may consider the external phenomena as simply in relation, and the internal phenomena also as simply in relation; the broadest and most complete definition of life will be—*The continuous adjustment of internal relations to external relations.*

At the same time that it is simpler and briefer, this modified formula has the further advantage of being somewhat more comprehensive. To say that it includes not only those simultaneous and successive changes in an organism which correspond to coexistences and sequences in the environment, but also those structural arrangements which *enable* the organism to adapt its actions to those in the environment, may perhaps be going too far; for though these structural arrangements present internal relations adjusted to external relations, yet the

continuous adjustment of relations can scarcely be held to include a *fixed adjustment* already made. But while this antithesis serves to keep in view the distinction between the organism and its actions, it at the same time draws attention to the fact, that if the structural arrangements of the adult organism are not properly included, yet the developmental processes by which those arrangements were established, are included. For it needs but to contemplate that evolution of the embryo during which the organs are fitted to their prospective functions, to at once see, that from beginning to end it is the gradual, that is, continuous, adjustment of internal relations to external relations. Add to which fact the allied fact, that those structural modifications by which the adult organism becomes better adapted to its conditions — those structural modifications which, under change of climate, change of occupation, change of food, slowly bring about some rearrangement in the organic balance—must similarly be regarded as continuous adjustments of internal relations to external relations. So that not only does the definition, as thus expressed, comprehend all those activities, bodily and mental, which constitute our ordinary idea of life; but it also comprehends, both those processes of growth by which the organism is brought into general fitness for these activities, and those after-processes of adaptation by which it is specially fitted to its special activities.

Nevertheless, superior as it is in simplicity and comprehensiveness, so highly abstract a formula as this, is scarcely fitted for our present purpose. Reserving its terms for such use as occasion may dictate, it will be best commonly to employ its more concrete equivalent—to consider the internal relations as "simultaneous and successive changes;" the external relations as "coexistences and sequences;" and the connection between them as a "correspondence."

CHAPTER V.

THE DEGREE OF LIFE VARIES AS THE DEGREE OF CORRESPONDENCE.

§ 121. ALREADY it has been shown respecting each of the other qualifications included in the foregoing definition, that the life is high in proportion as that qualification is well fulfilled; and it is now to be remarked, that the same thing is especially true respecting this last qualification—the correspondence between internal and external relations. It needs only to consider for a moment, the meaning of the correspondence, to render this fact certain, *à priori*. For if, as is manifest, the state of an organism is constantly affected by the state of its environment—if, as we know to be the fact, the changes of temperature, of composition, of hygrometric state, in the environment, as also those mechanical actions, and those variations of available nutriment which occur in it, are liable to stop the processes going on in the organism; and if, as is seen in the instances hourly afforded, the changes that take place in the organism have the effect of directly or indirectly counterbalancing these changes in the environment; then, it follows that the life of the organism will be short or long, low or high, according to the extent to which changes in the environment, are met by corresponding changes in the organism. Allowing a margin for perturbations, the life will continue only while the correspondence continues; the completeness of the life will be proportionate to the completeness of the correspondence; and the life will be perfect only when the correspondence is perfect. Not to dwell in general statements however, let us contemplate this law under its more concrete aspects.

§ 122. Looking at life in its lowest developments, we find that only the most prevalent coexistences and sequences in the

environment, have any simultaneous and successive changes corresponding to them in the organism. The vital processes going on in a plant, display adjustment solely to the continuous coexistence of certain elements surrounding its roots and leaves; and vary only with the variations produced in these elements by the sun—are wholly unaffected by the countless mechanical and other changes occurring around; save when accidentally arrested by these. The life of a worm is made up of actions referring almost exclusively to the tangible properties of surrounding things: all those visible and audible changes which happen near it, and are connected with other changes that may presently destroy it, pass unrecognised — produce in it no adapted changes: its only adjustment of internal relations to external relations of this order, is seen when it escapes to the surface on feeling the vibrations produced by an approaching mole. Answering as do the proceedings of a bird to an immense number of coexistences and sequences in the environment, cognizable by sight, hearing, scent, and their combinations; and numerous as are the dangers it shuns, and the needs it fulfils, in virtue of this extensive correspondence; it exhibits no such actions as those by which a human being counterbalances variations in temperature and supply of food, consequent on the seasons—no actions such as those by which a human being entraps the prey he cannot run down. And when we see the plant eaten, the worm trodden upon, the bird dead from starvation; we see alike that the death is an arrest of such correspondence as existed; that it occurred when there was some change in the environment to which the organism made no answering change; and that thus, both in shortness and simplicity, the life was incomplete in proportion as the correspondence was incomplete. Evidently, if, as in those lowest organisms classed as protophyta and protozoa, the simultaneous and successive changes show an adjustment only to the most general coexistences and sequences in the surrounding medium; destruction will ensue when there occurs one of those less general coexistences or sequences to which no action in the organism

responds. And evidently the progress towards more prolonged and higher life, will be seen in the ability to respond to such less general coexistences and sequences. Every step upwards must consist in adding to the previously-adjusted relations which the organism exhibits, some further relation parallel to a further relation in the environment. And the greater correspondence thus established, must, other things equal, show itself alike in greater complexity of life, and greater length of life—a truth which will be duly realized on remembering that enormous mortality which prevails among lowly-organized creatures, and that gradual lengthening of individual life and diminution of fertility which we meet with on ascending to creatures of higher and higher development.

To avoid misconstruction, it may be well here to remark, that though length of life and complexity of life, are, to a great extent, associated—though a more extended correspondence in the successive changes commonly implies increased correspondence in the simultaneous changes; yet it is not uniformly so. If we contrast the two great divisions of life — animal and vegetable —we find that this relation by no means holds. A tree may live a thousand years, though the simultaneous changes going on in it correspond only to the few chemical affinities in the air and the earth, and though its serial changes correspond only to those of day and night, of the weather, and of the seasons. A tortoise, though exhibiting in a given time nothing like the number of internal actions corresponding with external ones, that are exhibited by a dog, yet lives far longer. The tree by its massive trunk, and the tortoise by its hard carapace, are saved the necessity of responding to those many surrounding mechanical actions which organisms not thus protected must respond to or die; or rather—the tree and the tortoise display in their structures, certain simple statical relations adapted to meet an infinity of dynamical relations external to them. Notwithstanding, however, the sundry qualifications which these two cases will suggest, it needs but to compare a microscopic fungus with an oak, an animalcule with a shark, a

mouse with a man, to recognize the general truth of the position, that this increasing correspondence of its changes with those of the environment, which characterizes progressing life, shows itself at the same time in continuity and in complication.

But it is, after all, unnecessary to insist upon this connection between length of life and complexity of life; seeing that, even were it not as conspicuous as it is, it would still be true that the degree of life varies with the degree of correspondence. For if the lengthened existence of a tree, be looked upon as tantamount to a considerable degree of life; then it must be admitted that its lengthened display of correspondences is tantamount to a considerable degree of correspondence. If otherwise it be held, that notwithstanding its much shorter existence, a dog must rank above a tortoise in degree of life because of its superior activity; then it is implied that its life is higher, because its simultaneous and successive correspondences are more complex and more rapid—because the correspondence is greater. And if, lastly, it be remembered, that we regard as the highest life, that which, like our own, shows great complexity in the correspondences, great rapidity in the succession of them, and great length in the series of them; we shall see it to be rigorously true that the degree of life varies as the degree of correspondence.

§ 123. For the further elucidation of this general truth, and especially for the explanation of the irregularities just referred to, it requires to be observed, that as the life becomes higher the environment itself becomes more complex. Though, in its largest acceptation, the environment must be held to mean all surrounding space with the coexistences and sequences contained in it; yet, practically, it often means but a small part of this. The environment of an entozoon can scarcely be said to extend beyond the body of the animal in which it lives: that of a freshwater alga is, virtually, limited to the ditch it floats in. And understanding the term in this restricted sense, we

shall see that the superior organisms inhabit the more variable environments.

Thus, regarding it in the mass, the lowest life is that found in the sea; and it has the simplest environment. Marine creatures are affected by no such multiplicity of coexistences and sequences as terrestrial ones. Being very nearly of the same specific gravity as the surrounding medium, they have not to contend with those various mechanical actions which mammals and birds are subject to in their motions on the earth and through the air. The zoophyte rooted to a stone, and the acalephe passively borne along in the current, need to undergo no internal changes such as those by which the caterpillar meets the varying effects of gravitation while creeping over and under the leaves. Again, this aboriginal environment —this environment to which all the earliest forms of life known to geologists belong—is liable to none of those marked alterations of temperature which the air suffers. Night and day produce no appreciable modifications in it; and it is but little affected by the seasons. Thus its contained fauna show no marked correspondences similar to those by which air-breathing creatures counterbalance thermal changes. Again, in respect to the supply of nutriment the conditions are far more simple. The lower tribes of animals inhabiting the water, like the plants inhabiting the air, have their food brought to them. The same current which brings oxygen to the oyster, also brings it the microscopic organisms on which it lives: the disintegrating matter and the matter to be integrated, coexist under the simplest relation. But it is otherwise with land animals. The oxygen is everywhere; but that which is needed to neutralize its action is not everywhere; it has to be sought; and the conditions under which it is to be obtained are more or less complex. So again with the fluid by whose agency only, the vital processes can be carried on. To marine creatures, water is ever present; and by the lowest is passively absorbed: but to most creatures living on the earth and in the air, it is available only after they have undergone those nervous changes consti-

tuting perception, and those muscular ones by which drinking is effected. Similarly, the contrast might be continued with respect to the electric and hygrometric variations, and the greater multiplicity of optical and acoustic phenomena with which terrestrial life is surrounded. And tracing upwards from the amphibia the widening extent and complexity which the environment, as practically considered, assumes—observing further how that gradually-increasing heterogeneity in the flora and fauna of the globe, which time has produced, has itself progressively complicated the environment of each species of organism—it might finally be shown that the same general truth is displayed in the history of the human race: whose advance in civilization has been simultaneous with their advance from the less varied requirements of the torrid zone to the more varied requirements of the temperate zone; whose chief steps have been made in regions presenting a complicated physical geography; and who, in the course of their progress, have been adding to their physical environment a social environment that has been growing even more involved. Thus, neglecting details, it is clear that as an average fact, those relations in the environment to which the relations in the organism must correspond, themselves increase in number and intricacy as the life assumes a higher form.

§ 124. As tending to bring into yet clearer view the fact that the degree of life varies as the degree of correspondence, I may here point out, that those other qualifications which were successively introduced when seeking to distinguish vital changes from non-vital changes, are all implied in this last qualification—their correspondence with external coexistences and sequences; and further, that the peculiarity seen in each of those qualifications—namely, that the higher the life the more it is fulfilled—is involved in the analogous peculiarity of this last qualification—namely that the life is high in proportion as the correspondence is great. To descend to particulars:—We saw that living organisms are characterized by successive changes; and

that as the life becomes greater, the successive changes become more numerous. Well, the environment is full of successive changes, both positive and relative; and the more complete the correspondence, the greater the number of successive changes an organism must display. We saw that life presents simultaneous changes; and that the more elevated it is, the greater the multiplicity of them. Well, besides the countless phenomena of coexistence, there are often many changes occurring at the same moment in the environment; and hence increased correspondence with it, presupposes an increased display of simultaneous changes in the organism. So, too, is it, with the heterogeneity of the changes. In the environment the relations are extremely varied in their kinds; and hence, as the organic actions come more and more into correspondence with them, they also must become extremely varied in their kinds. So again is it, even with definiteness of combination. For though the inorganic bodies of which the environment mainly consists, do not present definitely-combined changes, yet they present definitely-combined properties; and though the minor meteorological changes of the environment do not show much definiteness of combination, yet those resulting from day and night and the seasons do. Add to which, that as the environment of each organism comprehends all those other organisms existing within its sphere of life; as the most important and most numerous changes in the environment, with which each creature has to deal, are the changes exhibited by other creatures, whether prey or enemies; and as these changes are in more or less definite combination; it results that definiteness of combination is a general characteristic of the external changes with which internal ones have to correspond. Hence, increase of correspondence involves increased definiteness of combination. And thus it is manifest that throughout, the correspondence of the internal relations with the external ones is the essential thing; and that all the special characteristics of the internal relations, are but the collateral results of this correspondence.

§ 125. As affording perhaps the simplest and most conclusive proof that the degree of life varies as the degree of correspondence, it remains but to point out that perfect correspondence would be perfect life. Were there no changes in the environment but such as the organism had adapted changes to meet; and were it never to fail in the efficiency with which it met them; there would be eternal existence and universal knowledge. Death by natural decay, occurs because in old age the relation between the integrating and disintegrating processes going on in the organism, gradually falls out of correspondence with the relation between oxygen and food in the environment; and eventually the disintegrating process gets so far in advance, that the organism becomes unfit to act. Death from disease, arises either when the organism is congenitally defective in its power to balance the ordinary external actions by the ordinary internal actions, or when there has taken place some unusual external action to which there was no answering internal action. Death from accident, implies some neighbouring mechanical changes whose antecedents are either unobserved from lack of attention, or are so intricate in their dependencies that their consequences cannot be foreseen. In each of these cases the relations in the organism fail in their adjustment to the relations in the environment. Manifestly, if, to every outer coexistence and sequence by which it was ever in any degree affected, the organism presented an answering process or act; the simultaneous changes would be indefinitely numerous and complex, and the successive ones endless—the correspondence would be the greatest conceivable, and the life the highest conceivable, both in degree and in length.

§ 126. And now we may fitly proceed to study the gradual evolution of this correspondence, as seen in progressing from low to high types of life. Those more complex forms of internal change which constitute the subject matter of Psychology, cannot be adequately comprehended without a previous comprehension of those simple forms of it which constitute

life in its unintelligent phases. Fundamentally determined, as both these classes of vital relations are, by relations in the environment; and insensibly developed as we shall find the one class to be out of the other; we must take a general view of the entire series of facts, before attempting to interpret the latter part of the series.

Even in the prosecution of this preparatory inquiry, we shall find it needful to arrange the phenomena into groups. Indivisible as they really are, their multiplicity, variety, and complication, is such, that they cannot be truly seen from any one point of view; but must be contemplated under a succession of different aspects.

I may further premise that some of the illustrations and subordinate statements, by which the general argument is elucidated, must be taken with a certain latitude. The phenomena of Life are so complicated, and the modifications of them that occur under modifications of conditions, so various, that duly to substantiate each example of the application of any universal principle, requires preliminaries and qualifications specially referring to the peculiarities of the case; and to give these in every instance would inconveniently encumber the argument. Rather than do this, I prefer leaving those who have a critical knowledge of the facts, to recognize for themselves the occasional imperfections of statement; and to perceive, as I think they will, that these do not militate against the substantial truth of the proposition to be established. I will add, that while there are sundry instances in which, rather than confuse the argument, I have purposely omitted qualifications that might readily be supplied; there are possibly others in which I have unwittingly fallen into error. My acquaintance with physiology is simply that of an amateur; and in a science so extensive, and now undergoing such rapid development, only those who devote their whole time to it can be sure of all their statements. The truth of the doctrines enunciated, however, will be found quite independent of errors in detail, if such there be.

CHAPTER VI.

THE CORRESPONDENCE AS DIRECT AND HOMOGENEOUS.

§ 127. As the highest life is found in the most complicated environments, so, conversely, the lowest life is found in environments of unusual simplicity. Most environments present both coexistences and sequences; but there are some that during a limited period, present coexistences only; and in these, during this limited period, occur the organic forms to which, by common consent, is assigned the lowest place, both in respect of structure and vital properties. Of those classed with the vegetable kingdom, may be instanced the yeast-plant, and the *Protococcus nivalis* (red snow fungus). Of those held to be of animal nature, the *Gregarina*, and the parasitic cell which causes smallpox, may be taken as samples. The life of each of these organisms consists, almost wholly, of a few cotemporaneous processes in correspondence with the coexistent properties of the medium which surrounds it. The yeast-plant has for its habitat, a fluid consisting of water holding in solution certain hydrocarbons, some nitrogenous matter, oxygen, and probably other elements in minor proportions. That it may flourish, the temperature must be maintained within certain limits, and light must be excluded. These conditions being fulfilled, the yeast-plant displays what we call vital changes, in correspondence with the chemical changes of the elements bathing its surface —the cell grows; the fluid ferments: and while the fluid continues to supply the needful materials under the needful conditions, the cell continues to display the same phenomena. But let the temperature be considerably raised, or some of the ingredients exhausted, and the respective actions cease. The life, limited in length to the brief period during which the environment remains practically uniform, exhibits no successive changes such as those by which a shrub responds to the alter-

nations of day and night, of the seasons, of the weather. Excluding those modifications of form and size which are the necessary concomitants of continued assimilation, the only successive changes which the yeast-plant displays, in common with the higher plants, are those which result in the formation of spores. Dependent as they possibly are upon those alterations of the environment which continued fermentation produces—perhaps partly determined by the diminishing quantities of the materials needful for growth—these generative actions may be regarded as successive changes corresponding with successive changes in the environment; and most likely there is no organism but what, in addition to the simultaneous processes taking place in it, undergoes a serial process of this character. Evidently, however, the two orders of change, answering in this case to the two all-essential functions of assimilation and reproduction, exist under their simplest forms, in correspondence with the simplest relations in the environment; and ending as they do with that new state of the environment soon arising, the life is as short as it is incomplex.

It is needless to present in detail each of the other cases referred to. Substantially, they are severally of the same nature as the foregoing one. The *Protococcus nivalis* exists only in snow—a medium simple and constant in chemical character; confined in its variations of temperature; and which only under still more special conditions than those common to it, contains this microscopic fungus. Propagating itself over large tracts in the arctic regions in the course of a single night, during which the surrounding circumstances must remain almost uniform, this minute organism exhibits vital processes corresponding only to the surrounding coexistences; and can undergo scarcely any changes corresponding to surrounding sequences. To a new state in its medium, it does not adapt itself but dies: the snow melts and it disappears. Similarly with the *Gregarina*—a single-celled creature which inhabits the intestines of certain insects; which is bathed by the nutritive fluid it assimilates; which is kept at a tolerably constant temperature; and which can continue to exist

no longer than its special environment exists. And so too with the organic monads which constitute the virus of smallpox—monads which live in the blood; which multiply at the expense of certain of its constituents; which are preserved by it in conditions liable to little variation; and which cease to exist when their habitat has undergone that slight modification which the disease causes in the constitution. In all these cases the peculiarities to be noted are:—first, that the actions in the organism are in immediate dependence upon the affinities of the elements touching it on all sides; and second, that the internal processes of change proceed uniformly, or nearly so, because, during the brief time that the life lasts, the external relations remain uniform, or nearly so. The correspondence is at once *direct* and *homogeneous*. The disintegrating matter and the matter to be integrated, being everywhere diffused through the environment, it results that all the agents to which the vital changes stand related, are not only in *contact* with the organism, but *continuously* in contact with it. And hence the reason why there need neither those motions nor locomotions, which, where they are found, involve more or less heterogeneity in the correspondence.

§ 128. In strictness, no other forms of life than those of the kind just described, can be said to exhibit a correspondence at once direct and homogeneous. But the transition to higher forms is so gradual, that in making groups, it is impossible to avoid incongruities; and on the whole, it seems best to notice here a class of organisms, which, while they exhibit motion, either positive or relative, do so with comparative uniformity—a uniformity which implies that the correspondence is almost as homogeneous as in the cases above given. The ciliated spores of the algæ; the simplest of the ciliated animalcules; the most regular of the compound ciliated organisms, as the *Volvox globator;* together with the sponges and their allies; may be instanced as displaying this order of life.

Water, either fresh or salt, being in all these cases the

medium inhabited, the general fact to be observed, is, that the incipient heterogeneity in the vital actions, is in correspondence with the incipient heterogeneity of the environment. Though, from a human point of view, the fluids in which the yeast-plant and the *Gregarina* live, are far more heterogeneous than the water, either of the sea or of a pond; yet, relatively to these contained organisms, they are less so. For whilst on the one hand, every portion of the wort bathing the cell-wall of the yeast-plant, and every portion of the nutritive emulsion surrounding the *Gregarina*, presents the matter to be assimilated; on the other hand, every portion of the water in which a protozoon swims, though it presents oxygen, does not always present nutriment. In a concentrated form as the food of the first is, and in a dispersed form as is that of the last; it is clear that the external relations must be more homogeneous to the one than to the other. And manifestly, an organism whose medium is unceasingly disintegrating it, but is not unceasingly supplying it with integrable matter, but only presents scattered atoms of such integrable matter, must either traverse its medium with such velocity as shall bring it in contact with the requisite quantity of integrable matter, or must cause the medium to move past it with the like velocity — must either have a positive motion, as the infusory animalcule, or a relative motion, like that of the sponge towards the current of sea-water it draws in and expels. Thus then, the addition of mechanical change to the changes displayed by motionless organisms, is the addition of new internal relations in correspondence with new external relations.

Further, it is to be remarked, that the processes by which the movement is effected, are themselves in direct and almost homogeneous correspondence with certain almost ever-present properties of the environment. The fact that the ciliary action of fresh-water creatures ceases when they are put into sea water, and that of sea-water creatures when they are put into fresh water; joined with the fact that when the creatures displaying it have been killed, the ciliary action on the uninjured parts,

and even on parts that have been cut off, continues for a long time; and joined with the further fact, discovered by Virchow, that ciliary motion, which has ceased, may be reproduced by a solution of caustic potash; suffice to show, that the motion of these microscopic hairs is caused by the immediate contact of some matter or agent in the environment—consists of a succession of minute internal changes, in correspondence with those minute recurring actions of the medium which the waving of the cilia themselves involve. And the occasional suspensions and reversals of the motion, commonly so sustained, may possibly result from local deficiencies in the medium, of those materials or conditions that determine it; in which case, this slight heterogeneity in the mechanical changes, is in correspondence with a slight heterogeneity in the environment.

Other tribes of marine creatures, as the *Thalassicola*, display types of correspondence somewhat unlike the foregoing in character, though differing little in degree. But it is unnecessary to do more than indicate them.

CHAPTER VII.

THE CORRESPONDENCE AS DIRECT BUT HETEROGENEOUS.

§ 129. The advance, of which we have just marked the first steps, from a correspondence that is uniform to one that is varied, begins to show itself distinctly, under either an absolute or a relative change in the environment. In the case of plants, it is seen when, from a habitat in which the elements are not only ever-present in immediate contact with the organism, but ever in a fit condition for absorption by it, we pass to a habitat in which the needful elements, though ever present, are not always in a fit condition for absorption. And in the case of animals, it is seen both on passing from the protozoa to the larger aquatic creatures, which by their increased size and consequent necessity for larger prey are in the condition of having their nutriment less uniformly diffused, and on passing from aquatic creatures to terrestrial ones, to which the less uniform diffusion of nutriment is not relative only, but absolute. In all these instances the result is, that in addition to a correspondence with ever-present coexistences in the environment, we have now a correspondence to certain sequences in it. Let us glance at each class of cases.

§ 130. In the higher plants, which require not only carbonic acid and oxygen, but light, a certain temperature, a certain soil, and a certain quantity of moisture, we find variations in the vital actions corresponding with the variations which the environment undergoes in respect to these conditions—variations corresponding with those of the hour, the weather, and the seasons. As we lately saw, the lowest life continues only so long as its environment remains practically homogeneous, both in Space and Time. The next highest order of life must

be looked for in organisms displaying correspondence with the *most general* changes to which the environment is liable: and this is the kind of life which the vegetable kingdom at large exhibits. These changes in quantity of light and heat, are not only most general as occurring with greater regularity in time and degree than any others, but also as affecting the whole mass of the medium by which the organism is surrounded. And thus, in virtue both of their periodicity and universality, as well as by their comparative slowness, they produce only that small degree of heterogeneity in the environment, to which the small degree of heterogeneity in the visible changes of plant-life corresponds.

It should be further remarked, that the greater complexity of correspondences, and therefore greater length in the series of correspondences, which these higher plants display, involves an additional group of vital processes necessitated by increase of size. The long-continued growth rendered possible by this completer adjustment of internal relations to external relations, implying, as it does, a greater and greater remoteness in the parts of the organism from each other, supposes some means whereby these remote parts shall be put in communication; and hence a circulatory system. Or perhaps it may more strictly be said, that a circulatory system is necessitated by increase of size, joined with the division of the environment into the two halves, soil and air; and if so, the only respect in which the plant displays mechanical action, must be regarded as in correspondence with the only respect in which the elements in its environment are not coextensive in Space.

§ 131. Turning from plants to plant-animals (zoophytes), we see that while in them, there are certain general successive changes corresponding like those of plants with general successive changes in their environment, they more manifestly exhibit certain special changes, corresponding with special changes in it. While to the chemical, thermal, and hygrometric actions affecting the whole mass of its surrounding

medium, the actions going on in the plant slowly respond; there is no response in it to the surrounding mechanical actions: as those of a wire-worm gnawing its roots; or a herbivore browsing on its leaves. On the other hand, the most conspicuous of the actions seen in a zoophyte, are those that result when its expanded tentacles are touched. To a relation of coexistence between tangible and other properties, presented in a particular part of the environment, there corresponds, in the organism, a relation of sequence between certain tactual impressions and certain contractions. Here there are several facts to be noticed. First, that being a stationary creature, whose medium does not supply matter to be integrated so uniformly as it supplies disintegrating matter, there arises the necessity, that the creature must obtain matter to be integrated, either by filtering out of its medium the minute portions it contains (as do those zoophytes and molluscs that absorb and expel currents), or by arresting those larger portions here and there moving through its medium; and to do this last, presupposes sensitiveness and contractility connected in the manner seen. Second, that the ability to respond, not simply to the coexistences and sequences presented by the whole mass of the environment, but to the coexistences and sequences presented by particular bodies in it, is an advance in the degree of correspondence. And third, that as these particular bodies, exhibit in virtue of their motions much more various changes than those which the environment in general undergoes, an increased heterogeneity in the correspondence is at the same time involved.

§ 132. Of all these cases however, it is to be remarked, as of those in the last chapter, that the correspondence between internal and external relations, extends only to those external relations which occur in absolute contact with the organism. Not only is it that the processes going on in the yeast-plant, cease, unless its cell-wall is bathed by the saccharine and other matters on whose affinities they depend; not only is it that the

tree must have its carbonic acid, water, earthy salts, ammonia, and the rest, applied directly to its surface in the presence of light and heat, and that until they are thus applied it remains inert; but it is, that in the lowest division of the animal kingdom also, the substances to be assimilated must come in collision with the organism before any correspondence between inner and outer changes is shown. Alike in those forms of life whose environment perpetually presents the disintegrating and integrable matters under the requisite conditions; those whose environment perpetually presents them, but under variable conditions; those whose environment, though not full of integrable matter, yet contains it in such abundance that mere random locomotion brings them in contact with a sufficiency; and those whose environment contains it in moving masses of such number, that though themselves stationary, chance brings them as many as they want—alike in all these forms of life, there is an absence of that correspondence between internal relations and *distant* external relations, which characterizes more highly-endowed organisms.

CHAPTER VIII.

THE CORRESPONDENCE AS EXTENDING IN SPACE.

§ 133. On ascending from the lowest types of life, in which the adjustment of inner to outer relations is thus limited, one of the aspects under which heightening correspondence shows itself, is the increasing distance at which coexistences and sequences in the environment can produce adapted changes in the organism. This progress takes place simultaneously with the development of the senses of smell, sight, and hearing; and ultimately of the higher faculties.

There is every reason to believe, that the susceptibilities to odours, colours, and sounds, arise by insensible degrees out of that primordial irritability with which animal tissue in its lowest forms, is uniformly, or almost uniformly, endowed. The saying of Democritus, that all the senses are modifications of touch, modern science goes far to confirm. The sense of smell is very obviously one which implies the *contact* of dispersed particles with a specially-modified part of the organism—is a sense which becomes operative, only when these particles are so carried by a current of air or water as to impinge upon this modified part. The sense of hearing is one by which we feel the vibrations of the air lying in *contact* with our bodies. As the skin at large is sensitive to a succession of mechanical impulses given by matter of some density; so, through that specialized portion of the skin known as the ear-drum, we are sensitive to a far more rapid succession of mechanical impulses given by matter of much greater tenuity. The sense of sight, again, is one by which the pulses or undulations of a yet more delicate medium are impressed upon us—undulations incomparably more rapid in a medium incomparably rarer. Here however, as before, a *contact* of the undulating medium with an adapted part of the surface, is the pre-requisite to any im-

pression. Hence in all cases, the sensations produced in us by things in the environment, really involve the mechanical action of some order of agency upon some part of our surface. In all cases if the vibrating, or moving, or resisting substance, be prevented from coming in collision with that part of the surface fitted to appreciate it, there is no sensation. In all cases therefore, touch, of a more or less refined order, is implied. Not only is it, however, that the conclusions of physicists afford support to this doctrine which Democritus taught; but it is that the conclusions of physiologists do the like. The organs of the special senses are every one of them developments of the dermal system—are modifications of that same tissue in which the tactual sense in general is seated. Nor is this all. It is a remarkable fact, which I state on the authority of one of our first physiologists, that the eye and the ear both exhibit a type of structure fundamentally the same with that seen in the *vibrissæ*, or most perfect organs of touch. Thus, whether the matter be considered anatomically, or physiologically, or physically, the inference is the same.

There are not wanting evidences that the senses in general have a yet deeper basis in those primordial properties of organic matter which distinguish it from inorganic matter. It is a conclusion to which many facts point, that sensibility, of all kinds, tactual and other, takes its rise out of those fundamental processes of assimilation and oxidation—integration and disintegration—in which Life, in its primitive form, consists. Though these facts cannot be held sufficient to establish such a conclusion, which must be regarded as more or less speculative; and though it is not necessary to the general argument that they should be here given; yet, they form so appropriate an introduction to the subject of the chapter—the extension of the correspondence in Space—that it will be desirable to devote a section to them.

§ 134. In the lowest members of the animal kingdom, whose bodies are so little organized as to be almost, if not quite,

homogeneous, the whole mass of tissue performs, in its imperfect way, all the vital functions. Every part exhibits more or less of that contractility which in higher creatures is confined to the muscles; that irritability which they show only in the nerves; that reproductive power which with them is localized; that absorption of oxygen which only their lungs perform; that power to assimilate which is eventually confined to the stomach; that excretory action afterwards divided among the lungs, skin, and kidneys. Where, as in the lowest creatures of all, the body consists of nothing more than a structureless, homogeneous, substance; and where, as in somewhat higher and larger creatures, the body is made up of little else than an aggregation of like cells, there is an almost complete community of functions throughout: and only as fast as the structure comes to be specialized, does each part lose the power of subserving other processes than its habitual one.

To this general truth should be added the supplementary one, that in a great majority of cases, if not throughout, the specialization of functions which progresses *pari passu* with vitality, never entirely obliterates this aboriginal community of functions. Even where "the physiological division of labour" has been carried to the greatest extent, most, if not all, of the tissues, retain a certain power of fulfilling each other's duties. In the human being, skin can discharge the office of mucous membrane; and mucous membrane of skin. Lungs and kidneys can to some extent supply each other's shortcomings. Upon emergency, muscle can secrete a species of integument in place of that which the dermal system usually supplies. In salivation, the glands of the mouth become supplementary excreting organs. And the skin, while having mainly the function of ejecting perspirable matter, yet remains, to some extent, both a respiratory surface, and an assimilatory surface.

Bearing in mind then these general facts, that throughout the organic or, as physiologists term it, the vegetative life — the life made up of unintelligent processes — bearing in mind that throughout this division of life, heterogeneity of

structure and function arise out of an aboriginal homogeneity, the traces of which are never entirely lost; we shall be prepared to find a certain parallelism of method and results, in the evolution of that other division of life, consisting of the sensory and motor actions. Here, too, we may look for a certain community of function throughout the whole organism—a possession by the whole organism of those susceptibilities which are ultimately located and developed in eyes, ears, nose, and the rest. The primordial tissue, which, by one process of differentiation and integration, gives origin to the internal and external systems—the visceral and nervo-muscular organs—must possess, to some extent, the powers of the last as well as of the first. Not only the fundamental separation into vegetative and animal functions, but the subdivision of each of these into all the minor processes and actions, must be regarded as so many specializations of the various properties which every part of the elemental tissue possesses in some slight degree. Let us glance at the genesis of the several senses from this point of view.

Between touch and assimilation, there exists, in the lowest animal forms, an intimate connection. Not only does assimilation necessarily presuppose touch; but, among the simplest protozoa, touch and assimilation are to a considerable extent coextensive: the tactual surface and the digestive surface are the same. The *Amœba*, a structureless speck of jelly having no constant form, sends out, in this or that direction, prolongations of its substance. One of these prolongations meeting with, and attaching itself to, some relatively fixed object, becomes a temporary limb by which the body of the creature is drawn forward; but if this prolongation meets with some relatively small portion of organic matter, it gradually expands its extremity round this, gradually contracts, and gradually draws the nutritive morsel into the mass of the body, which collapses round it and presently dissolves it. That is to say, the same portion of tissue is at once arm, hand, mouth, and stomach—is at once a sensory, motor, and digestive organ—

shows us the tactual and assimilatory functions united in one. And if we assume, as we may fairly do, that the stimulus which causes the contraction of this protruded part when its extremity touches assimilable matter, arises from the chemical relation between the two—is caused by a commencing absorption of the assimilable matter, an incipient digestion of it—we shall see a still closer relation between the primordial sense and the primordial vegetative function.

In the same phenomena we may trace a nascent sense of taste. The ability to discriminate between organic and inorganic matter, appears to be in some degree possessed even by these most lowly of the animal kingdom. The *Amœba*, the *Actinophrys*, the *Difflugia*, and other creatures of this order, do not appear to absorb indiscriminately all fragments of available size; nor do the tentacles of polypes, though their action is by no means uniform, commonly behave in the same way when touched by inorganic bodies as when touched by organic bodies. Evidently, therefore, the primordial tissue must be differently affected by contact with nutritive and with innutritive matters. And bearing in mind that to creatures living in water, the innutritive matters are, generally speaking, the insoluble, and the nutritive the soluble; bearing in mind, further, that in these primordial organisms, all parts perform the digestive function; it becomes highly probable, as above suggested, that the selective power which they appear to possess, is really due to the setting up of an assimilative process when assimilable matter is brought in contact with them, and to the absence of that process when the matter presented is not assimilable. Whence it would follow that this selective power, which is an incipient sense of taste, is, primarily, one aspect of that integrating action which mainly constitutes the life. And we shall see yet further reason for thus interpreting the facts, if we bear in mind that, even in its highest developments, tasting forms one link in the chain of assimilative actions; and that it itself results from a local assimilation. The mouth is part of the alimentary canal, which, throughout

its whole extent, secretes digestive fluids and takes up dissolved substances. The mouth does both these: its saliva is a digestive fluid; and in the act of tasting, some of the substances which this digestive fluid dissolves, are absorbed through the mucous membrane of the tongue and palate. Manifestly, therefore, all tasting, considered as a physiological act, is a modified assimilation.

Again, smell has the same root with taste, and remains throughout closely associated with it. In air-breathing creatures there is a tenable division between the two: the one taking cognizance of matters suspended in air; and the other of matters suspended in water. But in creatures inhabiting the water, the two senses can be but relative degrees of the same: the one responding to a more dilute solution of nutritive substance; the other to a more concentrated solution. As the soluble elements which surround a portion of animal matter, and cause a zoophyte to distinguish it, are not confined to the actual surface of such matter, but are diffused in the surrounding water with an abundance that decreases as the distance increases; it is obvious that a greater susceptibility will render the matter appreciable before there is absolute contact; and that so, taste must pass gradually into smell. The intimate connection of taste with smell, and of both with touch, is displayed even in man. The nerves of both are spread out under a membrane that is continuous with, and but a slight modification of, the skin; they lie under adjacent parts of this membrane, close to its junction with the skin; they are so nearly allied in the sensations they give, that, knowing the smell of a substance, we can frequently form an approximate judgment of its taste; and to both, the substances to be recognized, must be presented in solution—the sapid particles either ready dissolved, or dissolvable by the saliva, and the odorous ones condensed by the film of moisture covering the membrane which lines the nose. Thus, even in ourselves, the difference is less between the modes in which the sensations are ultimately produced, than between the forms under which the

substances producing them originally exist—liquid or solid in the one case; gaseous in the other. Further, the relationship of the sense of smell to the fundamental organic actions, is traceable, not only through its affiliation upon the sense of taste, but is traceable directly. Not only is it that in low, aquatic creatures, smell and taste must be united by transitions such as those by which we insensibly pass from absolute contact to an appreciable distance in space, and that therefore smell has a common root with taste in the vegetative processes; but it is that even in its highest forms, its connection with them remains visible. The nostrils are simply divergent branches of the alimentary canal, from which, in the embryo, they are not separate; and absorbing into the system, as they do, some of the floating particles given off by the food that is being eaten, or is about to be eaten, their action, too, is but an evanescent form of assimilation. Add to which, that in so far as the olfactory action is not assimilative it is respiratory; and thus, in a sense, lies between the two original vital processes.

Once more, there are facts which indicate that in its initial stages, even the faculty of sight is implicated with the functions of organic life; and that it arises by gradual differentiation from these. The organisms which occupy the border land between the animal and vegetable kingdoms, share with plants the ability to decompose carbonic acid under the influence of light. Water containing protozoa gives off oxygen on exposure to the sun's rays. The link between the two great divisions of living forms, which these lowest creatures present in structure, development, and chemical character, they would also appear to present in their nutritive action. Now, considering this community of nature displayed by these lowest and simplest organisms, it is not an unreasonable expectation, that, on passing from them to vegetable and animal organisms respectively, we shall on the one hand find the ability to decompose carbonic acid by the agency of light, more and more developed, and on the other hand, more and

more wanting. Standing alone, this expectation would go for little; but joined with recently disclosed facts, it is significant. Observe, in the first place, that the researches of Schultze go to establish an identity between the colouring matter of the *Hydra, Turbellariæ,* (and several *Infusoria,*) and the chlorophyl of plants. And then, in the second place, observe, that the *Hydra* habitually shuns the light—habitually chooses the dark side of the vessel in which it is placed. Are not these two facts strongly suggestive of the conclusion, that the sensitiveness to light which the Hydra exhibits, results from the action which the light produces in its contained chlorophyl; that this action, being like the action produced in the chlorophyl of plants, is an assimilative action; and that thus, the power which the primordial tissue possesses to distinguish light from darkness—a power which forms the germ of the visual faculty—is the result of a modification produced by light upon the general vital activity? Any doubt that may be felt respecting this hypothesis, will, I think, be greatly diminished, on remembering that even in ourselves, the body in general retains a physiological sensitiveness to light; and that this sensitiveness is of the same order as that described. The darkening of the skin produced by continued exposure to bright sunshine, is nothing else than a modification of the assimilative action going on in the dermal tissues—a change in the absorption of materials supplied by the blood. And as, in transparent and semi-transparent creatures, any alteration in the assimilative action must pervade the whole body; it is easy to understand how the presence of light may produce marked changes in such creatures.

That the faculty of hearing, has, like the others, a root in the primitive vital processes, there is little if any direct evidence. But that in its nascent stage it is dependent upon them, may be suspected from the fact that, to sound as to light, the whole animal organism in its simplest forms, possesses a feeble susceptibility. A sharp blow, causing a vibration to pass through the vessel containing them, is responded to by creatures in whom

no sign of a hearing organ exists. And if we call to mind the facts that congenitally deaf persons have acute perceptions of sonorous vibrations in the bodies they touch; and that they can even perceive such vibrations in the air, when produced by a loud concussion, as a cannon shot—if we infer, as we must, that even with ourselves, the whole body is in a certain degree sensitive to sound; that the extreme sensitiveness of one part is simply a specialization of this general sensitiveness; and that it is in consequence of the great strength of the special impression that we cease to be conscious of the general impression—and if we further remember that in so dense a medium as water, the general impression must be much more powerful, especially on organisms much like water in specific gravity, and of lax tissue—we shall have no difficulty in understanding how the humblest zoophytes and molluscs may be distinctly affected by those rapid undulations which constitute objective sound. Such undulations must, in fact, permeate the entire mass of one of these soft-bodied creatures, almost as though it were so much water: and doing this, it can scarcely fail so to disturb the tissues in their ultimate structure, as to produce a marked change in their general state; and some consequent change in the external manifestations. Still it may be asked:—How do these facts tend to affiliate the faculty of hearing upon the aboriginal vegetative processes? I reply:—They tend to do so in so far as they suggest that the contraction produced by any sonorous vibration permeating a zoophyte's body, results from some modification of the vegetative processes. Such evidence as we have on the matter, implies that the life of the almost homogeneous tissue of which these simple creatures consist, is little else than the cumulative result of the lives of its component cells and granules; which severally absorb the nutrient juices percolating among them; are severally bathed by the oxygenating medium; and severally carry on the integrating and disintegrating actions by and for themselves. Now, anything which causes a sudden agitation of the aerating and nutritive fluids diffused through this lax tissue—anything

which accelerates the confused circulation of them which we must presume to be going on; will produce a sudden accession of vital activity in all the components of the tissue. A rapid succession of undulations propagated through the mass must do this. And we have but to suppose that the increased vital activity of each component, is accompanied by some change in its form—due, perhaps, to osmotic action, or electricity, or both—to understand how a contraction of the entire creature may result.

Thus, there is not a little reason to think that all forms of sensibility to external stimuli, are, in their nascent shapes, nothing but the modifications which those stimuli produce in that duplex process of assimilation and oxidation which constitutes the primordial life. No part of the tissue of a zoophyte can be touched, without the fluids diffused throughout the adjacent parts being put in motion, and so made to supply oxygen and food with greater rapidity. Nutritive matter brought in contact with the surface, which, in common with the rest of the body, assimilates, must cause a still greater excitement of the vital actions; and so must cause the touch of organic substances to be more promptly responded to than that of inorganic substances. A diffusion of nutritive matter in the form of an odour, will tend in a slight degree to produce analogous effects. The tissue having the requisite chemical nature, light, also, must modify the assimilative actions. And, as just shown, sonorous vibrations probably do the like. We only need to make the very reasonable assumption, that the component parts of these almost unorganized creatures, are severally changed in form by changes in their vital activity—an assumption which the phenomena of endosmose and exosmose, would alone go far to justify—to see that the various sensibilities are rooted in the primordial vegetative life. A liberal interpretation of the facts, serves to confirm the deduction from the universal law of organic progress—the deduction that as the aboriginal tissue out of which, by continuous differentiation and integration, arise the organs of vegetative

life, possesses, to some extent, the functional powers of all those organs; so must it, to some extent, possess the functional powers of the organs of animal life, and among them of the senses; which similarly arise out of it by a continuous differentiation and integration. And hence we find reason, not only for thinking with Democritus that the other senses are modifications of the sense of touch; but for regarding all orders of sensibility as developments of the purely physical processes with which life commences.

Closing here these speculations respecting the genesis of the several faculties through which the animal organism holds communication with the external world, let us now go on to our immediate subject—that extension of the correspondence in Space, which takes place simultaneously with the evolution of these faculties.

§ 135. Arising insensibly, as, in aquatic creatures, smell does out of touch and taste, it is not to be expected that in its nascent form it should be detected without careful experiments; and I have not met with any accounts of such. "How far any sense of smell exists in the lower invertebrata, cannot be satisfactorily determined," says Dr. Carpenter; "but it would seem not improbable that even where no special organ is apparent, some part of the general surface may be endowed with olfactive sensibility." Certainly, analogy would lead us to suppose, that before the sense of smell is manifestly present, it is present in a less observable degree. But be this as it may, it is clear that only when in some degree localized, does it become a means whereby internal relations can be brought into something like definite correspondence with external relations that do not occur in actual contact with the surface of the body. Supposing, merely for antithesis sake, that, in common with its many other diffused faculties, the organism in general originally possesses a feeble susceptibility to odours; it is manifest that the only correspondence capable of being established by means of it, must be seen in some state of

readiness to seize the prey or avoid the enemy, whose proximity an odour implies. Though, by means of such endowment, an inner relation can be adjusted to an outer relation not in actual contact with the surface; yet, there can be no correspondence to relations of either direction in space or distance in space. But when there exists a susceptibility that is to some extent localized, the organism must be differently affected by an odoriferous body, according as it is situated in this or that position; and when, as an accompaniment of specialization, there is increased efficiency, it is clear that a less strongly smelling body coming near to the more highly sensitive tract, may produce a response as great as that which a strong odour pervading its environment, would produce on an organism possessed of a diffused but inferior susceptibility—a response too, displaying some adjustment, both to direction and distance in space.

Passing from these vague beginnings of the olfactory sense, respecting which we as yet lack data for determining anything specific, it will be obvious that in proportion as there is developed at the entrance of the respiratory passages, a definite apparatus capable of being excited by floating particles, organic and other; in the same proportion must there be an extension of the space through which coexistences and sequences in the environment, can establish corresponding coexistences and sequences in the organism. When we trace up the evolution of the faculty to that great perfection in which it is possessed by land animals that hunt by scent, we see that one of the aspects under which the advance presents itself, is, the increasing distance at which certain inner and outer relations can be brought into adjustment; and that, other things equal, there is a simultaneous advance in the degree of life.

§ 136. Whatever may be the explanation of the fact, it is beyond question that in zoophytes the entire tissue has the property of responding to marked changes in the quantity of the light falling upon it; and that thus there is a foreshadow-

ing of the visual faculty, and a vague indication of certain consequent correspondences, before yet there is any visual organ. This power of discerning the difference between light and darkness, does not produce anything like what we call sight, until it comes to be concentrated in a particular spot. The rudimentary eye, consisting, as in the *Planaria,* of a few pigment grains beneath the integument, may be considered as simply a part of the surface more irritable by light than the rest. We may form some idea of the impression it is probably fitted to receive, by turning our closed eyes towards the light, and passing the hand backwards and forwards before them. Manifestly, however, as soon as even this slight specialization of function exists, it becomes possible for the organism to respond to the motion of opaque bodies that pass near. While yet there is nothing but a general sensitiveness to light, the intercepting of the sun's rays by a cloud, an observer's hand, or anything which throws the whole or a greater part of the creature into shade, is required to produce an internal change; but when there comes to be a specially sensitive part, anything which casts a shadow upon that part alone, can cause an internal change. And as that which shades the light from only a small part of the organism, will usually be a comparatively small object; it follows, that this advance from the general sensitiveness of the whole organism, to the special sensitiveness of one portion of it, enables the organism to respond, not only to the most marked general changes in luminousness which its environment undergoes, but also to those most marked special changes in luminousness caused by the motion of bodies in immediate proximity.

The contrast between light and darkness, or more strictly, between widely different degrees of obscuration, being all that the most rudimentary vision recognizes; and any very distinct obscuration produced by an adjacent small body, requiring that it shall be extremely close; we may reasonably infer that nascent vision extends only to those objects which are just about to touch the organism, either in consequence of their

motion or of its motion. We may infer that it amounts, at first, to little more than anticipatory touch; and that so there is established in the organism a relation between visual and tactual impressions, corresponding to the general relation between opacity and solidity in the environment. Be this as it may, however, it is clear that as soon as there comes to be a faculty of sight, though the vaguest imaginable in the sensations it gives, and the most limited that can be conceived in range, there is not only some extension of the correspondence in space, but a new order of correspondence makes its appearance.

It scarcely needs to say, that gradually as we ascend to creatures endowed with more complete visual organs, we find a gradual increase in the sphere of surrounding space through which external relations can establish corresponding internal relations. The first improvement, which apparently consists of nothing more than a slight convexity of the skin lying over the sensitive tract, must manifestly, by concentrating the rays, render appreciable, less marked variations in the quantity of light; and this must alike render perceptible the same bodies at a greater distance, and smaller or less opaque bodies at the same distance. From this point upwards, through the various families of mollusca, articulata, and vertebrata, inhabiting the water, and still more on passing to the rarer medium in which the highest creatures exist; we trace, under various forms and modifications, a more complex visual apparatus and a generally increasing distance through which the correspondence extends. It is needless to go into details. All hypotheses and illustrations aside, it is obvious that from the polype which does not stir till touched, up to the far-sighted vulture or the telescopic-eyed Bushman; one aspect under which progressing life shows itself, is the greater and greater remoteness at which visible relations in the environment can produce adapted relations in the organism.

§ 137. Similarly with the faculty of hearing. So long as

the power of responding to sonorous vibrations is slight, and possessed by the body at large, there can be no response to those moderate and localized vibrations the appreciation of which constitutes what we commonly understand as hearing. Only when the susceptibility comes to be intensified in one place, can there be any appreciation of a sound proceeding from a particular point in the environment, as distinguished from the mere tremor of the environment as a whole. When there exists the rudimentary ear, consisting of a dermal sac containing otolithes, which have the function of concentrating the vibrations striking the skin that covers them, as the primitive cornea concentrates the rays passing through it; then, it is obvious, that a moderate sound occurring in close proximity to this sac, may produce on the organism as great an effect as the violent shock of its entire medium produces on an organism not thus endowed. And when a dawning sense of hearing arises, there comes into existence a new set of correspondences between certain auditory impressions and consequent motions in the organism, and certain sound-causing powers and coexistent properties in adjacent bodies.

As in the previous cases, the successive improvements in this faculty are seen in the expanding sphere of space throughout which a certain order of relations in the environment cause adapted relations in the organism. Passing over details, which indeed existing knowledge scarcely suffices to supply, it cannot be denied that though the minor irregularities involved by their special habits and discipline are considerable, yet, viewed in the mass, animals of higher and higher types exhibit a greater and greater range in their auditory correspondences.

§ 138. This continual widening of the surrounding space through which the correspondence between inner and outer relations extends, does not end with the perfecting of the senses. In creatures of comparatively advanced organization, there arise powers of adjusting the actions of the organism to coexistences and sequences in the environment that are far too

remote for direct perception. No matter what the special mode in which it is achieved, it is clear that the process by which a carrier pigeon finds its way home, though taken a hundred miles away, is a process that cannot be effected by sight, smell, or hearing, in their direct and simple forms. Chased animals that make their way across the country to places of refuge that are out of immediate view, obviously do this by means of some combination of past and present impressions—a means which enables them to transcend the sphere of the senses. And thus also it must be with creatures that undertake annual migrations.

In man, this secondary process of extension becomes still more marked. Though, in respect to the correspondences effected by immediate perception, his range in space is narrower than that of some creatures of greatly inferior endowments; and though, in respect to that species of indirect adjustment of the organism to remote coexistences in its environment, just exemplified, he is inferior to sundry wild and domestic animals; yet, by the use of still more indirect means, he adjusts internal relations to external relations that are immensely more distant than those cognized by lower beings. By the combination of his own perceptions with the perceptions of others, as registered in maps, he can reach a special place lying thousands of miles away over the surface of the earth; and not only one such place, but endless such places. A ship, guided by compass, and stars, and chronometer, brings him from the other side of the Atlantic, information by which his purchases here are adapted to the prices there. An examination of the surface strata, from which he infers the presence of coal below, enables him to bring his actions into correspondence with the coexistences a thousand feet underneath. Nor is the range of environment through which his correspondences reach, confined to the surface and the substance of the earth. It stretches into the surrounding sphere of infinity. It was extended to the moon when the Chaldeans discovered how to predict eclipses; to the sun and nearer planets when the Copernican system was

established; to the remoter planets when an improved telescope disclosed one, and calculation fixed the position of the other; to the stars when their parallax and proper motion were measured; and, in a vague way, even to the nebulæ, when their composition and forms of structure were ascertained.

§ 139. Before leaving this general proposition, that the progress of life and intelligence, is, under one of its aspects, an extension of the space through which the correspondence between the organism and its environment reaches, it may be needful to remark, that its truth is entirely independent of all conclusions as to the modes in which the correspondence is affected. With a view of indicating the probable continuity of the higher vital actions with those lower ones in which life commences, I have, in the earlier part of the chapter, filled up some of the gaps in our positive knowledge by reasonings that are more or less hypothetical; and by so doing, have opened the door to possible criticisms, which may at first sight be supposed to tell against the doctrine at large. But it needs only a moment's consideration to show, that by whatever steps the senses of smell, sight, and hearing, take their rise, the result remains the same. It is beyond question that in the lower types of animal life, where yet the sense of touch is the only one definitely manifested, the correspondence between the organism and its environment, extends only to that part of the environment by which the organism is actually bathed. It is beyond question that the appearance of the higher senses, even in their most rudimentary forms, is accompanied by some extension of the surrounding space throughout which correspondences can be effected. It is beyond question that the successive stages in the development of each of these senses, more or less regularly involve successive enlargements of this sphere of space. And it is beyond question that the advent of rationality, is, among other ways, shown in the carrying of these enlargements still further.

Here indeed, it may be well specifically to point out, what is

obviously suggested by some of the facts cited above, that the extension of the correspondence in space, is exhibited, not only in the ascending grades of animal life, but in the successive phases of human civilization; and that it is even now going on. From the early races acquainted only with neighbouring localities, up to the modern geographer who can calculate the distance and direction of any point on the globe—from the ancient builders and metallurgists, knowing only surface-deposits, up to the geologist of our day, whose data in some cases enable him to describe the material existing at a depth never yet reached by the miner—from the savage barely able to say in how many days a full moon would return, up to the astronomer who ascertains the period of revolution of a double star—there has been a gradual widening of the range of environment throughout which the adjustment of inner to outer relations extends. And the fact that this is one of the aspects under which human progress has displayed itself, cannot fail to bring home with increased vividness the larger fact, that it is one of the aspects of vital progress in general.

It only remains to advert to the illustration thus afforded of the general truth, that the degree of life varies as the degree of correspondence. On the one hand, it is obvious that each new increment of space through which the correspondence extends, adds to the number of external relations to which internal relations are adjusted—adds, that is, to the number of internal changes—adds therefore to the amount of life. On the other hand, it is obvious that the greater the space throughout which the correspondence extends, and the greater the number of correspondences which can consequently be effected, the greater must be the number of cases in which food can be obtained and danger shunned, and the greater the ability to maintain life. Whence we may clearly see, how life and ability to maintain life, are two sides of the same fact—how life is a combination of processes the result of whose workings is their own continuance. A glance at the obverse of the proposition will serve still further to enforce it. For if, starting from the

forms of life treated of in the last chapter, whose correspondences do not extend beyond the phenomena occurring in contact with their own surfaces, we ask under what form a greater correspondence between the organism and its environment must show itself; we at once see that it must show itself in adjustments to relations that do not occur in contact with the organism; that correspondences having been established to the few relations occurring in juxtaposition with the organism, the number of correspondences cannot be increased without beginning to take in relations that do not occur in juxtaposition with it; that with more or less regularity this must remain true of subsequent additions to the number of correspondences; and that thus the growth of a correspondence between the organism and its environment, necessarily involves a gradual extension of the correspondence in space.

CHAPTER IX.

THE CORRESPONDENCE AS EXTENDING IN TIME.

§ 140. It was pointed out some pages back (§ 130), that while, in those humblest protophyta and protozoa in which the cell-wall is continuously bathed with all the needful elements, there is no manifest adjustment of internal changes to changes in the environment, the higher plants pass through cycles of states in correspondence with the cycles of the seasons. Whether this should be regarded as a progress towards correspondence in Time, is somewhat doubtful. On the one hand, it may be said, that as, in a tree, the periods of budding, blossoming, ripening the fruit, and dropping the leaves, are adapted to successive external conditions, the inner sequences are conformed to the outer ones. On the other hand, it may be argued that this is but an incidental result of the perpetual adaptation of the internal actions to external coexistences (temperature, light, moisture), which, by passing through a series of variations, involve a parallel series of variations in the plant. It may be argued that the putting forth of leaves has reference simply to the then existing concurrence of certain environing influences, and has no direct reference to the subsequent nutrition of the fruit; that a succession of environing influences produce a succession of adjusted processes in the plant, and that the production of fruit is simply a cumulative result of these; that the true nature of these vegetative changes is seen in the fact, that a tree will blossom in the autumn if the temperature be sufficiently high; and that thus, plant life exhibits no true correspondence to *sequences* in the environment, but only to *coexistences* in it. Definitely to decide between these views is not easy; though on the whole the last one seems the more philosophical. But at any rate, this species of correspondence

in Time, if such it be, is of an indirect and vague kind compared with that properly so called.

Setting aside this debateable case of the constitutional changes which all organisms undergo in response to the seasons, and turning to those more definite cases which animal life in particular displays; it is to be observed that in creatures not endowed with sensibility, as well as in those possessing no other sense than that of touch, the sole external relations with which internal relations can be put in correspondence, are relations of *coexistence*. It is only when there comes to be some amount of smell, sight, or hearing, that *sequences* in the environment can be met by adjusted sequences in the organism. The relation between the tangibility of an adjacent body, and some coexistent property possessed by it, is the only one to which, in a zoophyte, the organic relation between irritation and contraction answers. Time is no more involved in the correspondence than Space. But when relations among things or attributes that are in any degree removed from the organism, become cognizable—when, for example, there exists incipient vision, and obstruction of light is habitually followed by a touch from the obstructing body; then, an organic response to an external relation of sequence becomes possible; then, it becomes competent to the organism to move in anticipation of motion in an external body. Two phenomena in the environment, the one immediately succeeding the other, can produce two phenomena in the organism in like succession. And thus, an extension of the correspondence in Time, begins simultaneously with its extension in Space.

Or to present the proposition under another aspect:—As the simplest sequences, and those first cognized, are mechanical sequences; as mechanical sequences involve change of position; as change of position involves progress through Space; it follows, that only when there comes to be some degree of space-penetrating faculty, can there be any adaptation in the organism to changes of position in adjacent objects—any adjustment to external sequences—any correspondence in Time. After the

ability to respond to the touch of surrounding bodies, the next advance is the ability to respond to that motion of them which precedes touch; and as motion involves both Time and Space, the first extension of the correspondence in Time is necessarily coeval with its first extension in Space.

§ 141. Throughout the successive stages in the development of the perceptions, these two orders of correspondence must progress together with more or less regularity. In proportion as the distance at which a moving object is cognizable, increases, the greater becomes the duration of the external sequence, or chain of sequenees, to which the internal actions may be adjusted. Other things equal, the more remote any body in the environment, the longer must be the period before it can act on the organism or the organism on it; that is—the more extended must be the time between those outer anteeedents and consequents with whieh the inner antecedents and eonsequents are put in correspondence. The inner and outer sequences exhibited in the pursuit of a heron by a hawk, are longer than those exhibited in the pursuit of a fish by a heron; and are so ehiefly because the vision of a heron is more extensive than that of a fish. And without giving cases, it will be manifest, that by smell and hearing also, in proportion as they are aeute, the eorrespondences are simultaneously extended in duration and distance. Not that there is a constant ratio between these forms of advancing correspondence. The connection between them is variously modified by circumstances. The special character of the environment, the partieular powers of the organism in respect of locomotion, as well as other conditions, greatly affect it. All that can be established, is, that the two kinds of extension are connate; and that, in so far as mechanical phenomena are eoncerned, they display throughout a general interdependence.

§ 142. This limitation—"in so far as mechanical phenomena are concerned"—serves to introduce the fact, that, in respect to

other orders of phenomena, the progress of the correspondence in Time, has little or nothing to do with its progress in Space. Did all changes involve perceptible motion—were alteration of position a necessary accompaniment of every alteration, the two would be uniformly related. But as there are hosts of changes, chemical, thermal, electric, vital, which involve no appreciable mechanical change — as there are numberless changes of state which occur without change of place; it results, that in the growth of internal adjustments to these, there is an extension of the correspondence in Time, separate from, and additional to, that which arises from its extension in Space.

This species of correspondence in Time, is of a much higher order than that which is displayed in respect to most mechanical sequences—is in fact a far more extended correspondence. For the greater part of those mechanical sequences in surrounding bodies, by which any organism is affected, are incalculably more rapid than the non-mechanical sequences occurring in them. The motions of enemies or of prey, even when sluggish, are readily appreciable: a few seconds only, at most, is needed to bring about a manifest change. But the decay of a dead animal, the ripening of fruit, the drying-up of a pool, the hatching of an egg, require periods incomparably longer. Sequences of the latter order occupy a hundred, a thousand, a million times the periods required for those of the former; and the ability of the organism to adjust itself to them, implies a proportionably great extension of the correspondence in Time.

Hence the fact, that throughout all the lower orders of creation, it is only to coexistences and mechanical sequences in the environment that the actions of the organism respond. Hence the fact, that it is only when we come to creatures of a comparatively high degree of intelligence, that we meet with any inner changes in adaptation to outer changes of a non-mechanical kind. For we must not class as coming under this secondary species of correspondence in Time, those acts of the

inferior animals which are adjusted to the daily and annual modifications of the environment. These, like the parallel phenomena seen in plants, are most likely nothing but the cumulative results of successive adaptations of the organism to successive coexistences in the environment. It is anatomically demonstrable, that the pairing and nidification of birds in the spring, is preceded by constitutional changes, in all probability produced by more food and higher temperature. And it is a rational inference, that the whole series of processes implied in the rearing of a brood, are severally gone through, not with any recognition of consequences, but solely under the stimulus of the conditions immediately present from hour to hour, and day to day.

The earliest examples of the higher kind of correspondence in Time, must be looked for in cases where the period between antecedent and consequent is but a few hours. Birds that fly from inland to the sea-side to feed when the tide is out, and cattle that return to the farmyard at milking-time, supply instances. Even in these cases, however, it must be observed, that there is not a purely intelligent adjustment of the inner to the outer sequences; for creatures long accustomed to eat or be milked at definite intervals, necessarily come to have an adapted recurrence of constitutional states, and it is the sensations accompanying these states, which form the proximate stimuli to their acts. Nevertheless, we must not wholly exclude these instances from the category of advancing correspondence in Time: but must recognize them as imperfect and transitional forms of it, through which only the higher forms can be reached. For if we consider under what conditions only, a sequence in the organism can be adjusted to some lengthened sequence in the environment—some sequence occupying hours or days—it becomes manifest that there must exist in the organism, a means of recognizing duration. Unless the organism is capable of being differently affected by periods of different lengths, its actions cannot be made to fit slow external

actions. Now, when we pass from those mechanical sequences in which the motion of the external body itself serves the organism as a measure of duration, to those non-mechanical sequences which not only afford no measure, but last incomparably longer, it is obvious that the only measure of duration available, must be that arising from the periodic sensations of the organism itself. Hence the fact, that these first examples of the higher order of correspondences in Time, are examples in which an internal periodicity agrees with an external periodicity. And hence the fact, that in the cases next above these—cases showing some foresight of future events, such as is exhibited by a dog hiding a bone in anticipation of the time when he will be again hungry—there is a distinct reference to this same recurrence of organic states.

§ 143. The circumstance that there is so wide a gap between ordinary mechanical sequences and most non-mechanical sequences, in respect of the periods they occupy; joined with the circumstance that to effect a correspondence between internal sequences and lengthened external sequences, implies some mode of estimating time; serve at once to explain how it happens, that only when we reach an advanced phase of intelligence, does this higher species of correspondence in Time begin to exhibit a marked extension. It is not until we arrive at the human race that the slow vital, chemical, thermal changes undergone by objects in the environment, are met by adapted changes in the organism. Not that the transition is sudden. There is evidence that in the first stages of human progress, the method of estimating epochs does not differ in nature from that employed by the more intelligent animals. There are still historical traces of the fact, that originally, mankind adjusted their actions to the longer sequences in the environment, just as Australians and Bushmen do now, by observing their coincidence with the migrations of birds, the floodings of rivers, the flowerings of plants. And it is obvious

that the savages, who, after the ripening of a certain berry, travel to the sea-shore, knowing that they will then find a particular shell-fish in season, are guided by much the same process as the dog, who, when he sees the cloth laid for dinner goes to the window to watch for his master. But when it comes to be noticed that these phenomena of the seasons coincide with recurring phenomena in the heavens—when, as was the case with the aboriginal Hottentots, periods come to be recognized partly by astronomical, and partly by terrestrial changes; then, for the first time, we see making its appearance, a means whereby the correspondence in Time may be indefinitely extended. The periodicity of the sun's daily movements, and the monthly phases of the moon, having once been observed; and some small power of counting having been reached; it suddenly becomes possible to recognize the intervals between antecedents and consequents that are long apart, and to adjust the actions to them. Multitudes of external sequences whose lengths do not agree with those internal cycles produced by alternating light and darkness, nor with those that result in recurring appetites, and which, from having no organic periods answering to them, cannot be responded to by the organism, may be discerned and conformed to when there arises this ability of numbering days and lunations. Given a unit of Time, and a faculty of registering the units, and it becomes possible for the internal actions to be adjusted to those endless non-mechanical actions going on externally, which, though the least conspicuous, are often the most potent in their effects on the organism.

This higher order of correspondence in Time, which, for the reasons assigned, is impossible to creatures of inferior type; which is but vaguely discernible in the higher animals; and which is definitely exhibited only when we arrive at the human race; has made marked progress in the course of civilization. Among the lowest tribes of men, who are without habitations, and who wander from place to place as the varying supplies of

wild animals, roots, and insects, dictate, a year is the longest period to which the conduct is adapted. Hardly yet worthy to be defined as creatures "looking before and after," they show by their utter improvidence and their apparent incapacity to realize future consequences, that it is only to the conspicuous and often-recurring phenomena of the seasons, that their actions respond. But in the succeeding stages of progress, we see, in the building of huts, the breeding and accumulation of cattle, and the storing of commodities, that longer sequences are recognized and measures taken to meet them. And gradually as we advance to higher social states, men show, by planting trees that will not bear fruit for a generation; by the elaborate educations they give their children; by building houses that will last for centuries; by insuring their lives; by all those strugglings for future wealth or fame, which now mainly occupy the educated classes; that in them, internal antecedents and consequents are habitually adjusted to external ones that are extremely long in their intervals. More especially, however, is this extension of the correspondence in Time, displayed in the progress of science. Beginning with a recognition of the sequences of day and night, men next advanced to those monthly ones exhibited by the moon; next to the sun's annual cycle; next to the cycle of the moon's eclipses; afterwards to the periods of the superior planets; while modern astronomy determines the vast interval after which the earth's axis will again point to the same place in the heavens; and the scarcely conceivable epoch in which planetary perturbations repeat themselves.

And here it is to be remarked that in the case of these slow sequences, whose durations exceed in length the lives of individual men, the correspondence is effected by the agency of many men whose actions are co-ordinated. The astronomer who calculates the orbit of a comet of brief period, and who, after the lapse of certain years, months, and days, turns his telescope to that region of the heavens in which the expected

body shortly makes its appearance, exhibits in himself, the entire correspondence between an internal series of changes and an external one. But where centuries intervene between the prediction and the fulfilment, we see that by the help of language, the proceedings of several successive men are united into one long sequence, displaying the same adjustment to an external sequence as though it had occurred in a single individual living throughout the whole interval. Perhaps nothing tends so strongly to suggest the conception of an embodied Humanity, as this fact that Humanity in general, can respond to environing changes which are far too slow to be responded to by its component individuals.

§ 144. The extension of the correspondence in Time, like its extension in Space, both involves an increase in the amount of life, and renders possible a greater continuity of life. Each advance in the recognition of more and more elongated sequences, is an adjustment of a new set of internal relations to a new set of external relations—implies an additional series of vital actions—implies therefore an increase in the number and heterogeneity of the combined changes which constitute life. And at the same time, the adjustment of the organism to these successively longer sequences, is itself an avoidance of those dangers, or a seizing of those advantages, which such longer sequences present; and is consequently a process of self-preservation. Not only, as we have seen, do the ascending grades of brute life illustrate this; but it is illustrated by human progression. All the above instanced cases in which the more civilized races recognize slower changes, and provide for more remote results, than the comparatively hand-to-mouth-living savage does, are obviously cases in which a greater number of contingencies are met, and a greater duration of life secured: while, in the meeting of this greater number of contingencies, a higher degree of vital activity is necessarily displayed. And it may even be argued with some plausibility, that the like is

true, not only with respect to those shorter processes of causation which science discloses to us, but with respect also to the scarcely conceivable periods involved in the larger generalizations of astronomy and geology. For little as the recognition of these modifies human actions directly; yet indirectly, by throwing light upon the history and nature of the universe, and so influencing men's theories of creation and humanity, it ultimately produces a powerful effect upon the conduct of the race.

CHAPTER X.

THE CORRESPONDENCE AS INCREASING IN SPECIALITY.

§ 145. From another point of view, the evolution of life is an advance in the Speciality of the correspondence between internal and external relations. In part, this is another aspect of the processes delineated in the last two chapters; and in part, it is a further and a higher process. Just as we saw that in so far as mechanical phenomena are concerned, the extension of the correspondence goes on *pari passu* in Space and in Time, but that the extension of the correspondence in Time, afterwards takes in many other orders of phenomena; so, though at first the increase of the correspondence in Speciality is inseparable from its extension in Space and Time, yet it presently comes to include innumerable correspondences not comprehended under either of these. Objectively, the entire development of the correspondence is essentially one: the limitations of our intellects prevent us from grasping it as one: and it is an inconvenience accompanying the presentation of it in parts, that the divisions more or less overlap each other.

The first step in the specialization of the correspondence is seen on passing from those simplest of all organisms whose environments are homogeneous both in Space and Time, to those whose environments, though homogeneous in Space, are heterogeneous in Time. It is clear that the yeast-cell, touched on all sides by the elements required for its vital actions, and, during its short life, continuously supplied with them under the needful conditions, exhibits a correspondence in the highest degree general. And it is clear that the tree, which, though constantly bathed with nutritive materials, assimilates them

only under particular states of the environment, exhibits, in the adjustment of its internal changes to the recurring external changes, an advance towards speciality of correspondence.

The next step of the same nature—the step which distinguishes, so far as it can be distinguished, the animal kingdom from the vegetable one—takes place when, relatively to the needs of the organism, the environment is heterogeneous both in Time and Space. Generally speaking, we may say that while, to the lowest forms of life, the integrable matter is everywhere present under uniformly available conditions; while, to plants, it is everywhere present, but *not* under uniformly available conditions; to animals, it is *neither* uniformly present nor present under uniformly available conditions—it exists in particular bodies irregularly dispersed through the environment, which are to be obtained only by particular actions. And thus, change from a general diffusion of nutriment to a specialization of it, involves a further specialization of the correspondences. Unable to grow by mere passive absorption of surrounding elements, the condition under which alone the organism lives, is, that contact with special masses of matter shall be followed by the special acts required to utilize them. Even while yet there are neither prehensile nor digestive organs, we see, in the *Amœba*, which wraps itself round, and gradually includes, the small bodies it meets with, how necessary is the connection between this new set of external relations and a new set of internal ones. We see how the existence of its food in a solid form, necessarily implies that the organism shall respond differently to the contacts of solid matter and of fluid matter; and how this is a progress towards speciality of correspondence.

And when there arises the primary division of the tissue into stomach and skin—when the established differentiation in the environment, is met by an established differentiation in the organism—when to the ability to distinguish solid from fluid matter, comes to be added the ability to distinguish different orders of solid matter from each other, we see, dimly shadowed forth, those many successive specializations which accompany

the development of the senses. These we have now to consider.

§ 146. Out of the primordial irritability, which (excluding the indeterminate types of life that underlie both divisions of the organic world) characterizes animal organisms in general; and in virtue of which arises the response produced by the contact of solid bodies, as distinguished from the fluid medium; are gradually evolved those various modified kinds of irritability, answering to the various attributes of matter. The fundamental attribute of matter is resistance. The fundamental sense shows itself as a faculty of responding to resistance. And while, in the environment, associated with this attribute of resistance, are sundry other attributes severally distinctive of certain classes of bodies; in the organism, there successively arise faculties of responding to these other attributes—faculties, that is, which enable the organism to adjust its internal relations to a greater variety of external relations—faculties, therefore, which increase the speciality of the correspondence.

This is seen not only in the gradual process of differentiation by which the fundamental irritability gives origin to the senses that recognize the sapid, odorous, visible, and sound-producing properties of things; but it is seen in the series of phases through which each sense advances to perfection. For every higher phase shows itself as an ability to recognize smaller and smaller differences, either of kind or degree, in the attributes of surrounding bodies; and so renders it possible still further to specialize the adjustment of inner to outer relations.

In the case of touch, an advance is early shown in the power to distinguish a large moving mass from a small one, by the force of its collision. This is seen even in the zoophytes, which contract bodily if their tentacles are roughly handled, but draw in particular tentacles only if these are touched lightly. When, as in higher grades of creatures, a muscular system and a concomitant muscular sense are developed, there arises an appreciation of relative degrees of hardness in the

objects met with; as is proved by the differences between the actions which follow the contact with soft and hard bodies respectively. Afterwards textures become cognizable, and also amounts of tenacity; as illustrated in the act of a spider testing the strength of its web. Finally, when there come to be complicated prehensile organs, the sizes and shapes of the things laid hold of are perceived; and the conduct modified accordingly. And when all these subdivisions of the faculty of touch are fully developed, as in the human being, we find that between the extremes of hardness and softness a great number of gradations can be appreciated; that an immense variety of textures can be known tactually; and that endless objects can be identified by their differences of size and shape, ascertained by the fingers only.

That special kind of touch which we call taste, and which may be generally, though not accurately, described, as a sense serving to distinguish matters that are soluble from those that are insoluble, presents us with a series of gradations of like kind. Regarding only the lower families of creatures, which, if not without exception aquatic, are in all cases surrounded by a fluid of which water is the chief constituent, it is obvious that, to them, the insoluble bodies are one with the inorganic bodies, and that the soluble more or less completely answer to the organic. In the sea, or a river, matter which permanently continues undissolved, is stone or earth; while matter which, though soluble, is found in a solid form, is something alive. Hence, to those lowest creatures, which feed on any organic substance, the soluble and the insoluble,—the things that have taste, and the things that are tasteless,—stand respectively for food and not-food. From this stage upwards, successive specializations, of which we may presume the first to be in an ability to distinguish organic matter into animal and vegetable, display themselves in the narrowing of the classes of things which are eaten. Fish that take particular baits, insects and quadrupeds that feed on particular plants, illustrate this. Obviously, it is neither needful

nor practicable to trace out this progress in detail. It suffices to notice that the higher animals exhibit a power of perceiving an increased number of gustable differences; and that when we reach man, we find the faculty so far developed that it enables him not only to identify a great variety of edible substances, but serves the chemist and the mineralogist in classifying those inorganic compounds which are in any degree soluble.

Smell, which, as before suggested (§ 134), has probably a common origin with touch and taste in the fundamental process of assimilation, and is to all appearance gradually differentiated from these, passes through parallel stages of development. At first, merely, as we may presume, a kind of anticipatory taste, and in common with taste employed to distinguish nutritive from innutritive matters, it more or less manifestly progresses in speciality in proportion as the food is specialized; or to put the facts in logical order:—the ability to select special food, is in most cases dependent on the minuteness of the differences which the smelling faculty can appreciate. Not that this is so throughout; for prey is in many cases recognized by other means than scent: but it is so with most insects and plant-eating quadrupeds; and with a considerable proportion of creatures that are carnivorous. These gradations in the olfactory sense, which are most clearly displayed in the mammalia, reach in some of those that hunt by scent, to a high degree of perfection. Not only do we see in such, an ability to identify the species of creature pursued; but the dog, which, with nose to the ground, traces out his master, shows us that he can not only distinguish by scent one class of bodies from all other classes, but can even distinguish a particular individual belonging to that class, from all the other individuals it contains.

The increasing speciality of the correspondences effected by means of vision, in its ascending stages of development, is still more conspicuous. The lowest form of vision appears to be nothing further than a sensitiveness to the proximity of a body which intercepts the light. Marked differences in the quantity

of light, and such surrounding changes as cause these differences, are alone responded to. Presently, when less marked differences become appreciable, and when the sensitive tract on which the rays of light are concentrated, is such that a part of it can be stimulated without the stimulation of the whole; there arises an ability to distinguish adjacent objects by their power to reflect light, as well as by their power to intercept it. The differences in light-reflecting power possessed by white and black bodies having become appreciable, we may presume that a further progress of like nature renders perceptible smaller and smaller gradations in the transition from whiteness to blackness; and so adds to the number of things that can be discriminated. Then to increasing ability to recognize differences in the quantity of light, has to be added an ability to recognize differences in its quality; which, in all probability, arises simultaneously. Things that are red, yellow, and blue, come to be differentiated from each other in their effects on the organism; as well as those that are white and black. And familiar facts clearly show, that in the evolution of the visual faculty, the progress is towards a capacity to discriminate a greater variety of intensities of colour, of intermediate tints, and of degrees of light and shade. Gradually too, as there is developed a more expanded retina, and as, consequently, any marked differences in the areas occupied by images cast upon it become appreciable, there arises a possibility of distinguishing differences of bulk in adjacent objects. The approach of a large body changes the state of a greater portion of the retina than the approach of a small one; whence results an appropriate difference of action. And as in the case of amounts of light and qualities of colour, the successive advances result in the perception of smaller and smaller distinctions. Finally, there is reached the ability to recognize not only size but shape. A further specialization of the sensitive tract—a minuter division of it into separate nervous elements, renders it a fit instrument for this. Employed by an organism of proportionate complexity, an eye of advanced structure gives different impressions, not only according to the

number of its component nerve fibres that are simultaneously affected, but according to the *particular combinations* of them that are simultaneously affected: and the particular combinations, varying as they do with the forms of the bodies seen, serve as stimuli to the appropriately varied actions. All which several kinds of visual development displayed throughout the animal kingdom, end in giving to man the power to identify by the eye an infinity of different objects; and so to make an infinity of particular adaptations in his conduct.

Similarly with hearing. In its lowest form, nothing but a sensitiveness to violent concussions affecting the whole environment, this sense, when localized and developed, becomes a means of distinguishing differences in the strengths of the vibrations; that is—the loudness of the sounds. A moderate sound near to the aural organ, produces a different effect on the organism from one causing a distinct tremor of the whole surrounding fluid; and step by step, as the multiplying apparatus of which the ear essentially consists, exhibits a more perfect construction, a greater number of degrees of intensity become perceptible: as is illustrated by animals which listen, or pursue, or seek refuge, according as some neighbouring noise is faint, or moderate, or startling. Higher endowments of the faculty are further accompanied by increasing ability to discriminate qualities as well as quantities of sound. Birds which answer each other in the woods—birds whose songs are made up of intervals more or less truly answering to musical ones, and which may be taught definite melodies, must obviously be able to recognize a great number of differences in pitch. Parrots, whose range of imitations not only exhibits great compass in pitch, but great variety in *timbre*, show a power to appreciate that secondary order of qualities by which tones of the same pitch are distinguished from each other. By most domestic quadrupeds, and especially such as answer to their names, marked contrasts of pitch or timbre, or of both, are responded to. And among men, or more strictly speaking, among civilized men, the aural faculty reaches a development

which, besides enabling them to recognize numerous adjacent creatures, various mechanical operations, countless natural phenomena, by the sounds that accompany them, further enables them to identify unseen persons by the loudness, pitch, and *timbre* of their voices, and even to perceive the particular states of feeling in which such persons then are.

Thus, throughout the whole animal kingdom, the specialization of the senses is a measure of the specialization of the correspondences between inner and outer relations—is nothing but a means to such specialization. Not only in the differentiation of the senses from each other, but in the differentiation of each sense into those several divisions which eventually constitute it, and in the differentiation of each of these divisions into the minute subdivisions which render possible the appreciation of minute distinctions, we see a series of subjective modifications fitting the organism to respond to a greater and greater number of those objective modifications which characterize the things in its environment.

§ 147. But the increase of the correspondence in speciality, by no means ends with the development of the senses. Nor is it adequately represented, even among the lower animals, by a description of this development. For, during the same time that the advancing faculties of touch, taste, smell, sight, and hearing, have rendered it possible for the organism to respond to smaller differences in the simpler properties of things, there has been growing up a power of responding to those higher properties of things that are not cognizable by direct sensation. This makes its appearance so gradually, and is so intimately associated with the simpler functions of the senses, that it is scarcely possible to treat of the one without in some degree involving the other. Indeed, in the foregoing section, the boundary line has been crossed, alike in speaking of visible and of tangible form, and, to a smaller extent, in other cases.

What is the essential nature of this higher order of specialized correspondences, it will be more convenient to consider

hereafter under another head. For the present, it will suffice to say, that they are seen wherever Space or Time, or both Space and Time, are involved. Let us look at the matter in the concrete.

First it is to be observed, that in themselves, the extensions of the correspondence in Space and in Time, both imply increased speciality of correspondence; differing in kind from that above described, though inseparable from it in origin. A higher development of the eye, gives simultaneously a greater ability to identify distant objects, and a greater ability to discriminate between the relative sizes of near objects. And it is manifest that these connate abilities to identify objects at a distance, and to appreciate differences of apparent magnitude, give together a power of estimating distance: whence must arise differences of action, according as the perceived enemies or prey, are dangerously near or hopelessly remote; and these differences of action imply a new series of special correspondences. Manifestly, also, the extension of the correspondence in Time, involves analogous results: seeing that when, instead of responding only to those brief mechanical sequences which occur close to it, the organism possesses an ability to recognize mechanical sequences of longer duration, and afterwards non-mechanical sequences; and when, as a consequence, instead of meeting all these sequences by some one defensive action, as retreat into its shell, it becomes possible for it to meet them by different actions, according to their lengths; the correspondences must become, by implication, more and more special

This being understood, it will at once be seen that when that speciality of correspondence which exhibits itself in the discrimination of objects from each other, is united with that speciality of correspondence which exhibits itself in the discrimination of distances in Space or Time, there arises a new and a higher order of special correspondences; or more correctly—the previously specialized correspondences are still further specialized. And when, as during this same progress, there is developed a power of recognizing *direction* in space,

the speciality is again increased. To another set of distinctions in the environment, there is another set of adjustments in the organism. These general truths will be best elucidated by a few illustrations.

Among the lower aquatic creatures endowed with some degree of activity, and with vision extending to a few feet, may be observed cases in which the approach of any large object, is responded to simply by a series of convulsive movements, which may end in removing the creature to a greater distance from the approaching body, or in bringing it nearer, or in leaving it nearly where it was. The random leaps which a flea makes in its attempts to escape, are of like nature; showing, as they do, no recognition of the whereabouts of the pursuer. On the other hand, the movements of a fish when alarmed, or of a fly when approached by the finger, are, like those of all higher creatures, *away* from the object to be escaped. The particular direction of something in the environment, is responded to by a particular adjustment in the motions of the organism—the correspondence is comparatively special. When, again, not only the direction but the nature of a neighbouring body can be perceived, by virtue of its colour, or the sound it makes, or both—as exemplified in the deer that gallops away from a creature that barks but not from one that bleats, in the bee that flies towards a flower, in the trout that rises at one object but not at another—there is a yet further specialization. And as not only colours and sounds and directions, but magnitudes and forms and distances come to be appreciated, there result all those more definitely adjusted actions by which the higher animals elude danger and secure prey—actions such as those of the chamois springing from crag to crag; of the hawk pouncing upon its quarry; of the dog catching the morsel of food thrown to it; of the bird building its nest and feeding its young.

In like manner, that increased speciality involved by extension of the correspondence in Time, when joined with that increased speciality resulting from a better discrimination

of objects, gives origin to another series of higher specializations. There is a response to the sequences exhibited by particular classes of bodies; not simply to those exhibited by bodies in general. And manifestly, as fast as the number of sequences that can be distinguished from each other in length, accumulates; and as fast as there is a multiplication in the number of things distinguished from each other; so fast can there be an increase in the number of adjustments of the organism to the special actions going on in its environment. Save in respect to rapid mechanical changes, there are no correspondences of this order among the lower classes of creatures; and, lacking as they do the ability to estimate time, even the higher quadrupeds supply but few and imperfect examples of it. The lion that goes to the river side at dusk to lie in wait for the creatures which come to drink; and the house-dog standing outside the door in the expectation that some one will presently open it; may be cited as approximative instances. But only when we come to the human race, are correspondences of this degree of speciality exhibited with distinctness and frequency. In preparing his weapons against the approaching immigration of certain birds; in putting aside to dry, the skins which he preserves for clothing; in making the fire by which to cook his food; in various of his in-door and out-door actions; the savage adapts his conduct to the special changes undergone by special bodies during definite intervals.

Finally, we reach those still higher cases where there is speciality alike in space, time, and object—where the action of the organism is in correspondence with the changes of a particular thing in a particular spot at a particular period. A large proportion of human actions, even among the uncivilized, are of this nature. The going to certain places, at certain seasons, to gather certain natural productions then fit for use; the endeavour to intercept an animal that is making for a retreat, by getting there before it; these, and numerous daily procedures, exemplify this order of correspondences.

§ 148. Under this, as under previous aspects, an advance of the correspondence between the organism and its environment, is markedly displayed in the course of human progress. Not only is it that in the growth of classifications and nomenclatures we see the establishment of a greater number of distinctions among surrounding things, and a conforming of the conduct to their respective properties—not only is it that in the development of agriculture, the serial changes undergone by a variety of plants and animals have become known, and special materials, times, modes, places, adopted for the production of each—not only is it that the growth of the Arts has involved an incalculable multiplication of special processes adapted to produce special changes in special objects—not only is it that our whole social life, alike in the manufactory, in the shop, on the highway, in the kitchen, displays throughout, the performance of particular actions towards particular things in particular places at particular times; but it is that in what is commonly termed exact science, or rather in the actions that are guided by exact science, civilization presents us with a new and vast series of correspondences altogether transcending in speciality those that preceded them. For this that we call exact science, is in reality *quantitative prevision;* as distinguished from that *qualitative prevision* exhibited in ordinary knowledge. The progress of intelligence has gradually given the ability to say, not only that such and such things are related in coexistence or sequence; but that the relation between them involves such and such amounts of space, time, force, temperature, &c. &c. It has become possible to predict, not simply that under given conditions two things will always be found together; but to predict how much of the one will be found with so much of the other. It has become possible to predict, not simply that this phenomenon will occur after that; but to predict the exact period of time at the end of which it will occur, or the exact distance in space at which it will occur, or both. And manifestly, this reduction of phenomena to definite mea-

sure, gives to those proceedings of the organism that correspond with them, a degree of precision, a special fitness, far exceeding that possessed by ordinary ones. There is an immense contrast in this respect between the act of the astronomer, who, on a certain day, hour, and minute, adjusts his instrument to watch the commencement of an eclipse; and that of the farmer, who so arranges his work that he may have hands enough for reaping some time in August or September. The chemist, who calculates how many pounds and ounces of quick-lime it will require to decompose and precipitate all the bicarbonate of lime which the water in a given reservoir contains in a certain percentage, exhibits an adjustment of inner to outer relations incomparably more specific than does the washerwoman who softens a tub-full of hard water by a handful of soda. In the completeness of their adaptation to external coexistences and sequences, there is a wide difference between the proceedings of ancient besiegers whose battering rams were indeterminate in their action, and those of the scientific artillery-officer of our own day; who, by means of a specific quantity of powder, consisting of specific ingredients, in specific proportions, placed in a tube at a specific inclination, sends a bomb of specific weight, on to a specific object, and causes it to explode at a specific moment. Similarly with all the results of applied science; which not only gives greater speciality to previous correspondences, but renders possible hosts of correspondences before impossible. And when we bear in mind, not only that science, considered as the development of qualitative prevision into quantitative prevision, is thus distinguished by the relatively high speciality of the correspondences it achieves; but that, as contemplated in its own progress, it has been continually advancing in the precision of its results, alike in astronomy, physics, mechanics, chemistry—has been ever becoming more accurately quantitative, more special in its previsions; it becomes obvious, that even the most transcendent achievements of rationality are but the carrying still further that specialization of the correspondences between

the organism and its environment, which is displayed in the evolution of Life in general.

§ 149. To follow the practice adopted in previous chapters, it may be as well here to point out, that this increase in the speciality of the correspondence, like its extension in Space and Time, is both in itself a higher life, and contributes to greater length of life. Inability to distinguish between surrounding bodies of different natures, must necessarily be attended by fatal errors in the conduct pursued towards them; while, conversely, the greater the power to recognize the multitudinous distinctions among such bodies, the greater must be the number of special adjustments that can be made to them, and the more complete must be the self-preservation. The proposition is in essence a truism. It is almost a truism, too, to say, that in proportion to the numerousness of the objects or classes of objects that can be separately identified—in proportion, that is, to the number of distinct attributes and combinations of attributes that can be cognized; and in proportion to the number of coexistences and sequences that can be severally responded to; must be the number, and rapidity, and heterogeneity, of the changes going on within the organism — must be the amount of vitality. Indeed, there is apparently no single formula which so well expresses the entire progress of Life, as this increase in the speciality of the correspondences between inner and outer relations. For, taking the extreme case, it is clear that did the actions of an organism accurately respond to all the coexistences and sequences of all things whatever in its environment, its life would be eternal. And it is equally clear that the infinity of internal changes involved in effecting the correspondence with an infinity of external relations, would imply the highest conceivable degree of vital activity.

CHAPTER XI.

THE CORRESPONDENCE AS INCREASING IN GENERALITY.

§ 150. That the adjustment of inner to outer relations progresses in generality at the same time that it progresses in speciality, will be thought a contradiction. It is however a purely verbal contradiction: the generalities being of quite different orders. The correspondences we meet with in the lower forms of life, are extremely general in the sense that those relations in the environment to which organic relations respond, are everywhere present, and continuously present. During a summer's day, light, heat, and carbonic acid, coexist in all portions of the space surrounding a plant; and the dependent chemical changes within the plant, go on simultaneously in all its leaves, for as many hours as the surrounding elements remain in the same relation. Hence, the correspondence, involving neither any special point in space nor any special moment in time, is of a very general nature. And the like is the case with those inferior types of animal life, to which the environment presents both the disintegrating and the integrable matter in a diffused form. The generalities, however, to which the organism responds more and more the higher it advances, are not those exhibited by the mass of the environing medium; but those exhibited by the individual objects contained in it: and generalities of this kind can become cognizable only as the intelligence is developed. The condition under which alone there can be established in the organism, general relations corresponding to the general relations displayed in common by several different groups of bodies, but not by other groups, is, that it shall have such experiences of various groups of bodies as shall enable it to distinguish among them. Only when there comes to be a multiplication of the classes of separate bodies

that give it different experiences, can it possibly possess subjective generalities parallel to those objective generalities which bind together classes superficially unlike.

There are indeed generalities of a certain kind, which diminish in extensiveness as the specialities increase in number—generalities which form the raw material out of which specialities are produced by continual subdivision: the generalities, namely, in virtue of which surrounding objects are distinguished into classes. The growth of an ability displayed in successive orders of inferior organisms, to respond to the distinction between fluid and solid matter; then to the distinctions which respectively mark fluid, inorganic, and organic matters; afterwards to those of fluid, inorganic, vegetable, and animal matters; imply a correspondence to generalities that are step by step less comprehensive. And gradually as these classes become differentiated into smaller divisions, ending finally in species, they severally include fewer examples. These, however, are generalities, which, under their converse aspect, we have considered in the last chapter. For all special correspondences, with the exception of those highest ones which show themselves in the recognition of *individual* objects and acts, are really the manifestations of general correspondences covering certain groups of cases. The precautionary acts of a barn-door fowl on seeing a hawk hovering above, have no relation to that hawk in particular, but to the class of hawks in general. The correspondence is special, only in the sense of referring to the small class, hawks, instead of to the large class, birds. Even with respect to this order of generalities, however, it may be said, that as the formation of narrower and narrower ones does not involve the abolition of the wider ones which preceded them, but is merely an addition of secondary generalities to primary ones, there is an increase in the number of them, though not an increase in comprehensiveness.

But that advancing generality of correspondence which we have here to contemplate, is one which shows itself in the recognition of constant coexistences and sequences other than

those which serve for the establishment of special classes—co-existences and sequences that are common to many classes apparently distinct; and which serve to reunite under fresh categories, things and changes that have come to be regarded as entirely unlike. Instead of being seen in a response to the constant relation between a particular scent, and the colour, size, form, actions, and cries, of the creature possessing it—a relation that is simple, and uniformly presented—it is seen in a response to some such relation as that between bulk and weight, or inanimateness and passivity—a relation which extends beyond class limits, and obtains under great dissimilarity of appearances. Obviously the growth of generalities of this order, must follow a course just the reverse of that followed in the growth of the preceding ones.

To trace up this growth from the lower to the higher forms of life, after the manner pursued in previous chapters, is extremely difficult, if not impossible. For it is in the very nature of this species of correspondence, that it does not manifest itself in any distinct, uncombined forms. The extensions of the correspondence in Space and Time, as well as its increase in Speciality, are experimentally demonstrable; but an internal relation that is parallel to some external relation which is more or less abstract—which is not peculiar to definite classes of things—which has no particular concrete embodiment—cannot be distinctly identified in the conduct. Not in itself giving origin to special acts, but serving simply to modify the acts otherwise originated, it can be discovered only by analysis of these.

The sole method, then, by which the progress of the correspondence in generality can be traced, is, to ascertain the conditions under which alone such a progress becomes possible; and then to show how the processes of evolution already described, necessarily give rise to these conditions. Let us do this.

§ 151. The recognition of a generality of this higher kind,

embracing classes superficially dissimilar, implies a power of recognizing *attributes* as distinguished from the *objects* possessing them. Before any two fundamental properties that are found together under all varieties of size, form, colour, texture, temperature, motion, &c., can have their constant relation of coexistence responded to by the organism; it requires that the organism shall have an ability severally to identify these properties, as separate from their accidental accompaniments. The formation of simple class generalities, which group together phenomena that greatly resemble each other in *all* respects, requires no such distinct analysis of attributes. But where the resemblance is confined to some one essential relation common to many cases that in every other respect greatly differ, it is clear that unless the elements of this relation are separately cognizable by the organism, there can be no response to such relation.

Now it may readily be shown that the increase of the correspondence in speciality, must inevitably bring about this analysis of attributes—that there cannot be a continued multiplication of the distinguishable classes, without there being a simultaneous approach to the perception of properties in the abstract. For if, ascending from the lowest creatures by which but few attributes are cognizable, we step by step advance to those capable of being impressed by a greater and greater number of attributes—if, from the ability to distinguish large classes having but two or three attributes in common, we trace up the ability to distinguish the more special classes characterized by four, five, six, seven, &c., attributes in common, finally reaching the ability to distinguish individuals, which, while alike in the numerous attributes characterizing their species, differ only in one or two minor points; it is clear that in proportion as the groups of attributes become increasingly varied and special, there must be a more frequent *dissociation* of each particular attribute from others. Forms, colours, sizes, sounds, scents, motions, being found in all combinations —these two kinds of animals being alike in everything but

colours; those two, similar in colour but different in form and scent; and the others having nothing in common but size—the property A occurring here in company with the properties B, C, D; there with C, F, H; there with E, G, B; and so on with each property to a greater or less extent—it must happen, that by multiplication of experiences, the impressions produced by these properties on the organism, will be gradually disconnected from each other, and rendered just so far independent in the organism as the properties are in the environment. Whence there must eventually arise a power to recognize attributes in themselves, as separate from particular bodies.

It may indeed be shown, that the advance of the correspondence in speciality, itself becomes possible only in proportion to the progress of this analysis. An analogy will best explain this. Suppose that a chemist, having the requisite ability and materials, be required to produce artificially a variety of compound bodies: what is implied in his successful execution of the task? The implication is, that he knows the composition of each of these bodies. But what does knowledge of their composition presuppose? It presupposes that they have been severally resolved into their constituents. It presupposes an acquaintance with the elements of which these and various other compounds consist. And the formation of each of the required compounds, implies that the component elements, having been previously separated from all other combinations, shall be put together in the right proportions. Well, the process of identifying any object as a thing having a special nature, is a synthesis of impressions, corresponding to the synthesis of perceptible properties which the thing displays; and similarly implies a recognition of the separate impressions which correspond with these separate properties. The botanist, who knows a particular flower, not by the fructification alone, in which it is like many others; not by the number of its petals, which is a very usual number; not by their forms, in which they do not differ from these, nor by

their colours, in which they do not differ from those; not by the calyx, nor the bracts, nor the leaves, nor the stalk, separately considered; but by all these taken together; obviously effects the identification by a synthesis of attributes. And that which he does in this elaborate and conscious way, is done more or less completely in every case where an object is recognized as of special nature—is done in a degree proportionate to the speciality of the correspondence. Should it be said that this position, taken in connection with the previous one, involves a contradiction—that while the one represents the analysis of attributes as a *prerequisite* to speciality of correspondence, the other represents the analysis of attributes as *resulting* from increase of the correspondence in speciality—the reply is, that the two processes progress throughout in mutual dependence, perpetually acting and reacting on each other. Every advance in speciality must presently render the analysis of attributes more precise; and each step in the analysis of attributes renders possible a higher speciality.

Thus, then, we see that the course of evolution described in the previous chapters, is necessarily accompanied by a gradual disentangling of properties from each other; ending finally in an ability to recognize them in the abstract. The like process must later and more slowly take place with relations of sequence, as well as with relations of coexistence. An increasing speciality in the adjustments to mechanical changes, presupposes an increasing decomposition of those changes into their elements—a growing power to distinguish velocity of motion, direction of motion, acceleration and retardation of motion, kind of motion in respect of simplicity or complexity, and so on; and where non-mechanical sequences also come to be responded to, a parallel analysis must accompany a parallel progress in speciality.

The analysis of attributes having been carried to some considerable extent, there arises, and only then arises, a possibility of advance in generality of correspondence. Relations between properties possessed in common by objects of widely different

kinds, can begin to be perceived as soon as these properties are separately cognizable. And it needs but a little reflection to see, that a still higher progress in the specialization of the correspondences, ultimately involves this remaining step required for generalization of them. For if, as we have seen, the continual multiplication of special correspondences must result in the gradual dissociation from each other of all variable attributes—beginning with the separation of those most inconstantly connected, and progressing to the separation of those less and less inconstantly connected; and if, when the variable attributes displayed by a group of different classes have been as it were disintegrated in the consciousness of the organism, the remaining attributes that have not been disintegrated must begin to stand out from the rest, as preserving a constant relation amidst all these inconstancies; we see that in the end, there must be established in the organism, a constant relation corresponding to the constant relation between these attributes; and this constitutes the advance in generality we are looking for. Add to which, that as the comparatively constant relations thus first generalized from the experience of but few classes, will, in the majority of cases, be proved by wider experience to be not everywhere constant; and as, by the accumulation of these wider experiences, the same process must be gone through with the comparatively constant relations, as before with the less constant ones, with the result of bringing the *still* more constant relations into view; the progress must necessarily be from narrow generalizations to wider and wider ones. And this we know, *à posteriori*, to be the law which the progress conforms to.

§ 152. These explanations will suffice at once to show how it happens, that the increase of the correspondence in generality, is scarcely discernible in any but the higher forms of intelligence. Necessary as it is that there should be a great advance in the speciality of the correspondences, to produce the requisite analysis of attributes; and necessary as yet further

advance in specialization is, to bring into view the constantly related attributes as distinguished from the inconstantly related ones; it is only when that very high degree of speciality of correspondence characteristic of superior creatures is reached, that progress in generality of correspondence can begin. Hence the fact, that while the higher mammals undoubtedly display some generalities of correspondence of the least abstract kind, it is only when we come to the human race, that we find this species of adjustment of inner to outer relations, showing any considerable development.

Human progression, however, exhibits to us, under this, as under previous aspects, an immense increase in the harmony between the organism and its environment. Perhaps in no other respect is the increasing correspondence wrought out by civilization, so conspicuous, as in the growth of generalizations, ever more numerous and more comprehensive. The enormous expansion of science which these latter ages have witnessed, mainly consists in the union of many particular facts into general truths, and in the union of many general truths into truths still more general. It is needless to cite illustrations; for the proposition is familiar, and admitted by all. It will be enough simply to point to this great phenomenon as one of the many forms of the evolution we are tracing out.

A mere indication, too, of the extent to which the generalizations of science advance the arts, and through the arts minister to human welfare, will serve to show, that increase of the correspondence in generality, like its other modes of increase, makes possible a greater duration of life. And a like brief reference to the intense concentration of thought, and extreme complexity of conceptions, which these more abstruse generalizations imply, will sufficiently draw attention to the higher degree of life which must accompany this greater length of life.

CHAPTER XII.

THE CORRESPONDENCE AS INCREASING IN COMPLEXITY.

§ 153. Another change in our stand-point, affords us a view of vital progress, which, though not coextensive with foregoing ones, has much in common with them. As we saw that the extensions of the correspondence in Space and in Time, were in part reciprocal and in part not so; as we saw that the increase of the correspondence in Speciality, while to some degree comprised under the extensions in Space and Time, includes very much beside; so we shall find that while, throughout a certain range of cases, progress in Complexity is the same thing as progress in Speciality, yet neither includes all that the other does. Much of the early advance in Speciality does not imply advance in Complexity; and the higher forms of the advance in Complexity cannot without straining, be comprehended under advance in Speciality. But let us glance at the facts.

§ 154. In the progress from an eye that appreciates only the difference between light and darkness, to one which appreciates degrees of difference between them, and afterwards to one which appreciates differences of colour and degrees of colour—in the progress from the power of distinguishing a few strongly contrasted smells or tastes, to the power of distinguishing an infinite variety of slightly contrasted smells or tastes—in the progress from that lowest form of hearing, consisting simply in a response to any violent tremor of the surrounding fluid, to those higher forms of it in which differences of loudness are recognized, and by and by differences of pitch and *timbre*—in all those cases which present merely a greater ability to discriminate between varieties of the same simple phenomenon; there is increase in the speciality of the corre-

spondence without increase in its complexity. The insect which lays its eggs only on a plant having a particular odour; and the bird which is alarmed by a tone of a certain pitch, but not by one of another; exhibit an adjustment of inner to outer relations, as simple as that seen in the snail which withdraws into its shell on being touched. Though the stimulus responded to is more special, it is not more complex. In each case a single undecomposable sensation, is followed by certain muscular actions: and though these muscular actions are more intricate in the higher creatures than in the lower; yet the relation between the antecedents and consequents, is very nearly, if not quite, of the same order. But where the stimulus responded to, consists, not of a single sensation but of several; or where the response is not one action but a group of actions; the increase in speciality of correspondence results from an increase in its complexity.

In the development of vision we see this repeatedly illustrated. When, in addition to the usual relation between opacity and solidity, first responded to, there arises a response to the relation between solidity and the power to reflect light—when differences in the amounts and qualities of reflected light come to be recognized in connection with differences of bulk—when there arises a power to identify objects, not only by colour and size conjoined, but by form—when surrounding things are grouped in more and more numerous classes, that agree with each other in such and such peculiarities, but differ in others; it is manifest that each successive stage implies the appreciation of larger clusters of attributes. The impression received by the organism from each object, is a more complex impression—is increasingly heterogeneous. And when not only colour, size, and shape become cognizable, but also direction in space, distance in space, motion, kind of motion, direction of motion, velocity of motion—when, as by a falcon swooping on its quarry, all these external relations are simultaneously responded to; it is clear that the guiding perception must be compounded of many elements. There is no need to

dwell on this truth as further exemplified in the evolution of the other senses; nor to trace up in detail that yet higher complexity which results when the several senses are employed together. It suffices to cite an extreme case, such as that afforded by the mineralogist, who, in identifying a mass of matter as of a kind fitted for a certain use, examines its crystalline form, its colour, texture, hardness, cleavage, fracture, degree of transparency, lustre, specific gravity, taste, smell, fusibility, magnetic and electric properties, &c., and is decided in his conduct by all these taken together—it suffices to cite such a case as this, to show that throughout all the higher range of cases, increase in the speciality of the correspondence involves increase in its complexity.

§ 155. But, as already hinted, we eventually reach an order of correspondences in which the speciality and the complexity are no longer co-ordinate. A further advance in speciality is achieved by a much more than proportionate advance in complexity. In these cases, the adjustment of particular actions to particular circumstances, involves a far more extensive pre-adjustment of inner relations to outer relations, than is directly displayed. Let us look at an example or two.

The archer, who points his arrow, not at the object he seeks to hit, but above it, and who varies the angle of elevation according as the object is far or near, exhibits something more than a special response to special stimuli; for his procedure implies recognition of the fact, that bodies projected through the air, descend towards the earth, and that the amount of their descent has some relation to the distance traversed. Besides a correspondence with certain sensible relations in the environment, there is implied a correspondence with the law of certain other relations, not then present to the senses. Again, to take a more marked case:—the engineer who erects a suspension-bridge competent to bear a specified strain, is enabled to adjust his actions to the requirements, less by his inspection and measurement of the river to be crossed, than by his knowledge

of the strength of wrought iron, of the properties of the catenarian curve, of the composition of forces—his acquaintance with the universal truths of number, geometry, mechanics. In these cases the complexity of the correspondence is greatly in excess of the speciality. To bring out this fact by a contrast:—It might fairly be said that the Indian fish which catches insects flying over the surface by hitting them with jets of water, exhibits a correspondence as special as that seen in the archer; but considering that in the fish, the action implies nothing more than an automatic connection between certain visual impressions and certain muscular contractions—any modification of the one itself causing a modification of the other—it cannot be held that there is anything like the same complexity of correspondence. And similarly, though it might be plausibly argued that the strength of a spider's web is as specially adjusted to the demands to be made upon it, as is that of the engineer's suspension-bridge; yet it will not be contended that there is any comparison between them in respect of the variety and elaborateness of the actions implied.

If now we inquire whence arises this excess of complexity; we find that it is caused by the addition of generalities to specialities. Each of these higher correspondences displaying what we call rationality, implies an adjustment of inner relations not simply to the concrete outer relations then present; but to one or more of those abstract relations among external things, which previous experience has generalized. And as we advance to correspondences of still greater and greater complexity, we see that their leading characteristic is the increasing number of the abstract relations recognized, and involved in the process of adjustment. In these cases, there is a response, not simply to the particular phenomena presented in one part of the environment; but there is, as it were, a simultaneous response to sundry of the general phenomena presented by the environment at large. When we reach the highest achievements of science, as especially exemplified in astronomy, it becomes obvious that an exact adaptation of the actions of the

organism, to special actions in the environment, implies the pre-establishment of general relations in the organism, parallel to *all* those general relations in the environment which are in any way implicated with the phenomenon.

§ 156. There seems no place fitter than this, for drawing attention to the fact which has not yet been noticed, and which it is yet very important to notice, that there is a more or less constant ratio maintained between the *impressibilities* and the *activities* of the organism, in so far as their complexity is concerned. Considered under its most general form, every correspondence effected between the organism and the environment, involves two things—the reception of one or more impressions, and the performance of one or more appropriate motions. In the lowest animal types, we see a touch followed by a withdrawal of the part touched—a single impression followed by a single action. Gradually as we ascend, we observe an ability to receive increasingly complicated impressions, and to perform increasingly complicated actions. And the truth here to be observed, is, that the heterogeneity of the stimuli that can be received, is in general proportionate to the heterogeneity of the changes that can be displayed.

Before passing to the rationale of this, it may be well to remark, that from a teleological point of view, no other arrangement is admissible. As every advance in the correspondence between the organism and its environment, consists in the addition of some further internal adjustment to some further external relation; and as the ability to recognize the external relation is useless unless there is an ability to appropriately modify the conduct; it is clear that for the better preservation of life, the passive and active elements of the correspondence must progress together in speciality and complexity. A power to perceive the position of an object in space, must be accompanied by a power to specialize the movements; otherwise it can be of no service. The recognition of certain forms, colours, and motions as those of an enemy, will not

prevent destruction unless it be followed by such velocity of motion, such doublings, such leaps, as the enemy may be eluded by. The discrimination shown by a bird in the choice of materials for its nest, is so much faculty thrown away, unless there be sufficient constructive skill for nidification. It will not benefit the savage, to discover at what seasons and what times of the tide particular fish are to be caught, unless he has dexterity enough to make and use the apparatus needful for catching them. And so throughout, it must on the average happen, that every further differentiation of the perceptions, opening the way for a further differentiation in the actions, fails of its purpose unless an ability further to differentiate the actions is associated with it.

Leaving, however, all thought of ends to be subserved, we shall find the true explanation of this connection between progress in the impressibilities and progress in the activities, is simply that each necessitates the other—that they so act and react, that the advance of either involves the advance of both. The general relation between irritability and contractility, which, in the lowest types of animal life, constitute one indivisible phenomenon, is a relation which the sensitive and the active divisions of the organism, maintain throughout all their complications. They are co-ordinate in their origin; they are co-ordinate in their manifestations; they are co-ordinate in their progress. As certainly as the nervous and muscular systems make their appearance together; as certainly as, throughout the whole animal kingdom, they preserve a general parallelism in degree of development; so certainly is there an indissoluble connection between their respective functions in point of advancing complexity.

A general conception of this law will best be obtained by regarding the two functions under their most abstract forms—sensation and motion. Given an organism with certain sensory and motor faculties, and what must happen from the increase of either? Higher powers of motion and locomotion, must unavoidably bring the organism into relation with a

greater number of objects; and must so result in multiplying its impressions. Higher sensitiveness in the organism, must unavoidably entail more frequent stimuli to action; and must so multiply its motions and locomotions. Again;—The more varied a creature's activities, the more varied must be the relations in which it puts itself towards surrounding things; and hence the more varied must be the modes in which surrounding things affect it. And, conversely, the greater the variety of impressions receivable from surrounding things, the greater must be the number of modifications in the stimuli given to the motor faculties; and hence, the greater must be the tendency towards modified actions in the motor faculties. Thus, in respect both of activity and complexity, the progress of each is involved with the progress of the other.

But the necessity of this simultaneous development of the directive and executive faculties, will be most clearly seen on analyzing a few cases. Take as one, the ability to recognize direction in space. At first this may be thought to imply a development simply of the sensitive part of the nature—simply an expansion of the retina sufficiently great to admit of its several parts being separately affected by images falling upon them. But a little consideration will show, that something more is required than ability to perceive differences in the position of the image on the visual tract. Taken alone, these differences are meaningless: they come to have meaning, only when they are severally connected in the organism with those differences of motion required to bring the surface into contact with the things seen. As all psychologists admit, mere ocular impressions do not of themselves give any ideas of space. These arise, only when, by a growing experience, the impressions are referred to objects that can be touched by special muscular adjustments. Direction, therefore, cannot be perceived until there is not only a motor apparatus, but one so far developed as to effect specialized movements. And thus, the ability to perceive direction, and the ability to take advantage of the perception, are necessarily connate. The recog-

nition of distance, of velocity, of bulk, of shape, so obviously imply the like conditions, as merely to need mention. Again, differences of light and shade cannot be known to indicate variations of surface, until these variations have been disclosed by corresponding variations in the adjustments of the muscles; and so, complex muscular adjustments must be possible, before complex variations of light and shade can be interpreted. No definite idea of weight, as connected with visual appearances, can be arrived at, until there is a power of lifting, either by the jaws or limbs. Nor can differences of hardness and texture be assigned to surrounding objects, faster than the manipulative organs are perfected. And indeed, as these last instances suggest, it is not simply that the impressions made upon the senses require to be connected with the muscular experiences, before their meanings can be made out; but it is that the impressions themselves, in their higher forms, cannot be received without muscular aid. Perfect vision implies a focal adjustment of the eyes, an adjustment of their axes to the requisite convergence, a turning of them both towards the object, sometimes a turning of the head in the same direction, and sometimes also a turning of the body; all of which preparatory acts are performed by the muscles; and the last ones, not by the muscles of the eye, but by those of the body at large. Neither taste nor smell are possible unless the muscles of the tongue and the chest do their parts. Even hearing is imperfect unless the *membrana tympani* is strained by its muscles into concord with each successive sound. But above all, the knowledge acquired through the sense of touch, is especially dependent upon the motor apparatus. The mere existence of a sensitive skin, is but a small part of the requirement; as any one may prove by closing his eyes and applying his bare arm or leg to an unknown object. For the tactual impressions to be such as will give ideas of extension, form, solidity, this sensitive skin must be distributed over surfaces capable of deriving simultaneous or rapidly succeeding sensations from different parts of the things touched; and these

sensations must be combined with those muscular sensations accompanying the simultaneous and successive adjustments of the sensitive surfaces. There must be limbs to effect the larger and simpler adjustments; and appendages to them to effect the smaller and more elaborate ones. And only in proportion as these motor agencies become complex and complete, can there be completeness and complexity in the tactual perceptions. But these motor agencies—these limbs and appendages, with all the muscles they are moved by, are also the locomotive and manipulating organs; and the same elaborateness of structure which fits them to receive compound impressions, also fits them to perform compound operations. Thus, the evolution of the sensitive or directive apparatus, is inseparably involved with the evolution of the muscular or executive apparatus.

And here we may fitly notice a group of facts serving to illustrate this general law—facts exhibiting in the concrete, this constant relation between the impressibilities and the activities in respect of their complexity. I refer to the sundry striking instances, presented throughout the animal kingdom, of unusual sagacity coexisting with unusual development of the tactual organs. Why touch, which is in itself the simplest and earliest sense, should, in its higher forms, be more than any other sense associated with the advance of intelligence, will perhaps seem difficult to understand. The explanation lies simply in the fact, that tactual impressions are those into which all other impressions have to be translated, before their meanings can be known. If we contemplate the general relation subsisting between the organism and surrounding objects, we see that before they can affect it, or it can affect them, in any important way, there must be actual contact. Assimilation, respiration, locomotion, the destruction of prey, the escape from enemies, the formation of nests and burrows, the bringing up of young —all the essential functions, when considered in their ultimate natures, imply mechanical action and reaction between the organism and its environment. The space-penetrating faculties serve but as guides to this mechanical action; and the impres-

sions they receive, are primarily used but as symbols of tangible properties and relations. Hence it happens, that only as fast as the mechanical impressions, recognized by the muscles and the skin, become varied and complex, can there be a complete translation of the varied and complex impressions recognized by eyes, ears, and nose. The mother tongue must be as copious as the foreign; otherwise it cannot render all the foreign meanings. And thus, as seen in the facts referred to, a highly elaborated tactual apparatus comes to be the uniform accompaniment of superior intelligence. But let us look at these facts.

Just to show that each great family of the animal kingdom supplies them, I may mention in passing, that the *Cephalopoda,* which in point of sagacity are far in advance of other *Mollusca,* are structurally distinguished from them in having several arms by which they can grasp an object on all sides, at the same time that they apply it to the mouth; and again, that the crabs, which similarly stand at the head of the sub-kingdom *Articulata,* can bring their claws and foot-jaws simultaneously to bear upon anything they are manipulating. But merely glancing at these, let us content ourselves with examples supplied by the vertebrate tribes. It will be admitted that, of all birds, parrots have the greatest amount of intellect. Well, if we examine in what respect they are structurally most distinguished from other birds, we find it to be in development of the tactual organs. Few birds have such power of prehension with the feet, as to be able to grasp and lift up an object with the one foot, while standing on the other. The parrot, however, does this with ease. In most birds the upper mandible is scarcely at all moveable. In the parrot it is moveable to a marked extent. Generally, birds have the tongue undeveloped, and tied down close on the lower mandible. Parrots, however, have it large, free, and in constant employment. Above all, that which the parrot grasps in its claw, it can raise to its beak; and so bring both mandibles and tongue to bear upon what its hand (for it is practically a hand) already touches on several sides. A moment's consideration suffices to show, that

no other bird approaches to it in the complexity of the tactual impressions it can receive; and thus, advance of the directive faculties is manifestly involved by advance of the executive ones.

Among quadrupeds, again, it is unquestionable that as a general rule the *Unguiculata,* or those that have the limbs terminating in separate digits, are more intelligent than the *Ungulata,* or hoofed animals. The feline and canine tribes stand psychologically higher than cattle, horses, sheep, and deer. Now it is obvious that feet furnished with several sensitive toes, are capable of receiving more complicated impressions than feet ending in one or two masses of horn. While, by a hoof, only one side of a solid body can be touched at once; the divided toes of, for example, a dog, can simultaneously touch the adjacent sides of a small body, though not the opposite sides. And if we further bear in mind that the higher kinds of toed quadrupeds, while they cannot grasp with their feet, can nevertheless use them for holding down what they are tearing or gnawing with the teeth; we see that they can recognize tangible relations of considerable complication. Add to which the fact, that when, among the hoofed animals, we meet with any marks of sagacity, as in the horse, we find that the lack of sensitive extremities is in some measure compensated for by highly sensitive and mobile lips, which have considerable power of prehension. And here, indeed, we are naturally reminded of the most remarkable, and perhaps the most conclusive instance, of this connection between development of intelligence and development of the tactual organs—that seen in the elephant. I say most conclusive, because the elephant is markedly distinguished from allied tribes of mammals, alike by its proboscis, and by its high sagacity. The association between the operative and cognitive faculties stands out the more conspicuously, from the endowment of both being exceptional. On the intellect of the elephant there is no need to dwell: all know its superiority. The powers of its trunk, however, must be enumerated. Note first, its universality of move-

ment, in respect of direction. Unlike the ordinary mammalian limbs, whose motions are more or less confined to the vertical plane, its flexibility gives it as wide a range of positions as the human arm can take—wider, indeed, than can be taken by a single arm: and thus the elephant can ascertain the relations in space, both of its own members and of surrounding things, more completely than all other creatures, save man and the higher quadrumana. Again, the trunk can grasp bodies of every size, from a pea to a tree stump; and by this means can ascertain the tangible forms of a greater variety of objects than any of the lower mammalia. The finger-like projection with which the trunk terminates, receives impressions of the minor variations of surface; and so, textures and the details of shape can be made out, as well as general extension. Moreover, the complete prehensile power, giving ability to lift bodies of many sizes and natures, opens the way to a knowledge of weight, as connected with visible and tangible properties. The same power of prehension, used as it habitually is for the breaking-off of branches, brings experiences of the tenacity and elasticity of matter; and when employed, as these branches often are, for driving away flies, the swinging of them about must supply vague impressions even of momentum—impressions which the ability to throw small bodies (as gravel over the back) must tend to strengthen. Further, the trunk's tubular structure fits it for a number of hydraulic experiments, and so gives a knowledge of the mechanical properties of water, such as no other quadruped can attain to; and this same peculiarity, rendering it possible to send out strong blasts of air, producing motion in the light bodies adjacent, opens the way to yet another class of experiences. Thus, the great diversity of tactual and manipulatory powers possessed by the elephant's proboscis, is not less remarkable than is the creature's high sagacity—a sagacity which, dwelling in so ungainly a body, would otherwise be altogether inexplicable.

Passing to the quadrumana, we find repeated, under other

forms, this same relation between development of the intelligence, and development of the tactual appendages. It is seen not only in the contrast between them and inferior mammals; but it is seen in the contrasts between the subdivisions of the quadrumana themselves. The prehensile and manipulatory powers of the lower genera, are as imperfect as are their mental powers. As we advance to the highly intelligent anthropoid apes, we find the hands so modified as to admit of more complete opposition of the thumb and fingers; the bones of the forearm so articulated as to give the hand a power of rotation; the arms attached to the body in such a manner as allows them an increased range of lateral movement. And when, as in all the more perfect of the class, the structure of the fore-limbs is so complete, that an object can be grasped in one hand, while it is being manipulated with the other, or by the lips and teeth—can be held at the most convenient distance from the eyes—can be applied to any part of the body, or any neighbouring object—it is manifest, that more complex perceptions, of size, shape, structure, texture, hardness, weight, flexibility, tenacity, in their various combinations, can be received, than are possible to creatures whose limbs are less elaborately constructed. And thus the mutual dependence of the operative and cognitive faculties becomes clearly apparent.

How, in man, both exist in yet higher perfection, scarcely needs saying. As contemplated from an obverse point of view, the connection between them is abundantly exemplified in works on natural theology. All that it is desirable here to notice, is, the extent to which, in the human race, this perfection of the tactual apparatus has subserved the highest processes of the intellect. It is not simply that the tangible attributes of things have been rendered completely cognizable by the complex and versatile adjustments of the human hands—it is not simply that the greater knowledge of objects thus reached, opened the way for the making of tools, and consequently for agriculture, building, and the arts in general—it is not simply that by these were made possible, the settled and populous

societies without which none of the higher forms of intelligence can be attained to; but it is, that the manipulative powers directly underlie the sciences, including even the most remote and abstract. All developed science, consisting as it does of quantitative prevision—dealing as it does with *measured* results, is lineally descended from that simplest kind of measurement achieved by placing side by side the bodies held in the hands. Our knowledge of the forces governing the solar system, is expressed in terms that are reducible, by an ultimate analysis, to equal units of linear extension (§ 27), which were originally fixed by the direct apposition of like natural objects.* And the undeveloped sciences, consisting as yet of qualitative prevision, depending for their advance, as they do, either upon experiments requiring apparatus and skilful manipulation, or upon observations involving dissection and other analogous procedures, have similarly implied a highly-developed manual dexterity. Thus, the tactual apparatus not only serves in its lower forms to establish relations between the tangible and non-tangible attributes of things; but, in its highest forms, it indirectly serves to establish relations among the non-tangible attributes themselves.

This intimate connection between the impressibilities and the activities—between the directive and executive faculties, which we have traced in the first improvements of perception and locomotion, which we have seen exemplified in various creatures distinguished alike by their high intelligence and their developed organs of manipulation, and which we find to hold even with the human race—this mutual dependence of the cognitive and operative powers, which Anaxagoras had a glimpse of when he uttered his hyperbolical saying that animals would have been men had they had hands; is a relation yet more remarkably and more conclusively exemplified, in the reciprocity of aid exhibited by the Sciences and Arts. Strange as the proposition will at first sight seem, it needs but a little analysis to show, that the Sciences and Arts, when re-

* For explanation, see the before-mentioned essay on "The Genesis of Science."

garded subjectively, severally represent what in inferior creatures we call sensory and motor processes. The perceptions gained through the sensory organs and the actions performed by the motor ones, respectively become, under their most complex forms, scientific generalizations and manufacturing operations. A comparison of the extremes does not very obviously display this; but on looking at the transitions the filiation becomes manifest. It cannot be denied that the two attributes of irritability and contractility, possessed by all but the very lowest animal types, are the respective bases of the sensitive and motive faculties—that the senses exhibit subdivisions of the one, and the muscles specializations of the other. It cannot be denied that the increasingly complex perceptions to which each sense becomes the medium, together with the still more complex perceptions achieved by the union of several senses, are forms of the organism's impressibility; nor that the successive complications of motive, locomotive, and manipulative powers, are forms of the organism's activity. It cannot be denied that out of these more complex perceptions, woven into still more extensive combinations, finally arise the previsions of science; nor that all handicrafts, and after them the higher processes of production, have grown out of that manual dexterity in which the elaboration of the motor faculty terminates. And thus it cannot be denied, that sensation and the sequent motion are the prototypes of Science and Art. If, looking at the entire range of phenomena under their most general aspect, we consider the fundamental nature of the changes by which an organism adjusts itself to the environment; if we divide these changes, as we must, into those which external objects impress upon it, and those by which it appropriately modifies its relations to the external objects; if we name these respectively, the directive changes and the executive changes; we clearly see, that sensations, perceptions, conceptions, generalizations, and all forms of cognition, come under the one; while contractions, locomotions, and all kinds of operations, come under the other; and that Science and Art, so far as

they are separable at all, belong, the one to the first division, and the other to the last.

This truth being duly recognized, we shall at once see the significance of the fact, that throughout the course of human progress, there has been a reciprocity of services between the Sciences and Arts like that which we have traced out between the impressibilities and activities—a continuation of the same mutual dependence. History presents no generalization more certain, than that each great step towards a knowledge of the laws of things, has facilitated men's operations on things; while each more successful operation, has, by its results, facilitated the discovery of further laws. Astronomy and agriculture; geometry and the laying out of buildings; mechanics and the weighing of commodities; were among the earliest relations of the two. Presently, geometry, as developed by artificers, acted upon astronomy; and astronomy reacted to the great advancement of geometry. Through the medium of the scales, mechanics, joined with the science of number, influenced the metallurgic arts, gave definite alloys, introduced metallic instruments; and by so doing, both advanced the accuracy of astronomical and other observations, and improved all those processes of production for which metallic tools are employed. Metallurgy too, by supplying plane and concave mirrors, initiated optics; and the first proposition in harmonics was reached by the strings and weights which the arts furnished. Not to trace out this reciprocity in detail, it requires only to look at its modern manifestations, in the dependence of navigation on astronomy, magnetism, and meteorology; and the aid rendered to magnetic and meteorologic science by navigation—in the development of geology by mining, quarrying, and well-sinking; and the guidance which geology now gives in the search for coal, metals, and water—it requires but to observe how the definite compounds and elements with which chemistry deals, were at first brought to light by the arts; and that the arts are now all more or less dependent on chemistry —it requires simply to consider that there is scarcely a single

observation at present made in science, but what involves the use of sundry instruments, supplied by the arts; and scarcely a single art-process but what involves some of the previsions of science—it requires but to glance at these relations, to perceive, not only that the reciprocity exists, but that it has been ever becoming more active. And this last fact yet further elucidates the general truth we are contemplating. For, as we found when tracing upwards the directive and executive faculties, that in their higher developments they become more and more mutually dependent—that the completer forms of visual and tactual perception are impossible without complex muscular adjustments, and that the more elaborate actions require the constant overseeing of the senses; so, we now find that in the development of these still higher cognitive and operative processes, the advance is towards a reciprocity so active that each further cognition implies elaborate operative aid, and each new operation implies sundry elaborate cognitions.

Still more clearly will these correlations be perceived, on regarding them under their concrete aspect. From our present point of view we may properly say, that in its higher forms, the correspondence between the organism and its environment, is effected by means of supplementary senses and supplementary limbs. Whether a man crushes an object with his hand, with his teeth, with a vice, or with a hydraulic press, matters not in so far as the relation between the stimulus and the action are concerned; nor does it affect the fundamental nature of the perception, whether the relative lengths of two lines are determined by simple inspection, or by placing them side by side, or by means of a pair of compasses. Thus, all observing instruments, all weights, measures, scales, micrometers, verniers, microscopes, thermometers, barometers, &c., are artificial extensions of the senses; and all levers, screws, hammers, wedges, wheels, lathes, &c., are artificial extensions of the limbs. The magnifying glass adds but another lense to the lenses existing in the eye. The crowbar is but one more lever attached to the series of levers forming the arm and hand. And the relation-

ship which is so obvious in these first steps, must hold throughout. This admitted, and the reciprocity which we have traced between the higher cognitive and operative processes, will be yet more distinctly seen between their respective organs. The development of these supplementary senses, is dependent upon the development of these supplementary limbs; and *vice versâ*. Accurate measuring instruments, presuppose accurate instruments for turning and planing; and these cannot be made without the aid of previous measuring instruments of some accuracy. A first-rate astronomical quadrant can be produced only by a first-rate dividing engine; a first-rate dividing engine can be produced only by first-rate lathes and cutting tools; and so, tracing the requirements backwards, it becomes obvious that only by often repeated actions and reactions upon each other, can either directive or executive implements be brought to perfection. Only by means of artificial limbs can artificial senses be developed; and only through artificial senses does it become possible to improve artificial limbs.

These truths—this affiliation of the Sciences and Arts upon the lower forms of cognition and action; and this mutual dependence of the Sciences and Arts, whether considered in their respective processes or the agencies by which those processes are achieved—throw back a strong light upon the primitive connection of the impressibilities and activities. That reciprocity which we found to exist between these in their simpler forms, is a reciprocity which becomes yet more certain on discovering that it holds between those highest manifestations of the directive and executive powers displayed in human progression. When, after seeing how multiplied motions must produce multiplied sensations, and conversely —when after tracing up the like relation between increasingly specialized perceptions and increasingly specialized actions, we find it to obtain between these most complex cognitions and those most complex operations which we term Science and Art—and when we see, not only that these have developed together, but, by tracing their actions and reactions upon each

other, also see that neither could have advanced separately—when we see all this, it becomes an irresistible conclusion, that there exists throughout, that mutual dependence which analysis and induction indicate. It becomes an irresistible conclusion, that as discoveries in Science have improved the Arts, and improvements in the Arts facilitated discoveries in Science; so, from the beginning, each more developed impressibility has aided the activities, and each advance in the activities has opened the way to higher impressibilities.

Returning now from this long but needful digression, to our immediate topic—the increase of the correspondence in complexity—we perceive how, as was alleged, the two divisions of it simultaneously pass through parallel phases. Starting from the production of a single contraction by a single irritation, and step by step ascending to more heterogeneous motions and more heterogeneous stimuli; we find, in all stages, a more or less constant ratio preserved. Indeed, we may almost say, that, *à priori*, a complex operation is impossible without a complex cognition to guide it; while, conversely, a complex cognition is impossible without the experiences derived from complex operations: and so we may argue, that this duplexity in the progress is *necessary*. Moreover, it may be remarked, that not only do the directive and executive elements of the correspondence, develope hand in hand; but the kinds of complication they eventually assume are of analogous characters. That union of generalities with specialities which we found to distinguish the highly elaborated cognitions of Science, is visible also in the highly elaborated operations of Art. Just as a particular conclusion in Science, is reached by applying to special data a general principle, which general principle applied to other data, gives other conclusions; so, a particular product of Art, is obtained by subjecting to special manipulations, the results of some more general process, which results of some more general process, subjected to other manipulations, yield other art-products. And thus the parallel holds, not only between the

degrees of these mutually-dependent complexities, but also between their kinds.

§ 157. That this increase of the correspondence in complexity, exhibited in the ascending developments of Life in general, has continued throughout human civilization, we have incidentally seen in the course of the above argument. The gradual evolution of Science and Art, just traced out with another aim, so abundantly exemplifies this, as to render further exposition unnecessary. There is, however, one aspect of this progress which it may be well to notice; namely—the advance that has taken place, not simply in the complexity of the cognitions and operations that have been age by age attained to, but in the ability to receive complex cognitions and perform complex operations.

For it is not, as most suppose, that scientific and artistic progress, is due simply to the accumulation of knowledge and of appliances; but it is that the impressibilities and activities have themselves grown to a higher complication. There is distinct evidence from various quarters, that the minds of the inferior human races, cannot respond to relations of even moderate complexity; much less to those highly complex relations with which advanced science deals. According to the traveller, Lieutenant Walpole, it is remarked of the Sandwich islanders, by their teachers, "that in all the early parts of their education, they are exceedingly quick, but not in the higher branches; that they have excellent memories, and learn by rote with wonderful rapidity, but will not exercise their thinking faculties." That is to say, they can readily receive simple ideas, but not complex ones. Again, it is asserted of the Australians, that "some of them are very quick at acquiring knowledge, but they have no power of combination or concentration."* The reports of Hindoo schools, disclose, though in a less marked manner, the same fact. And according to Mr. W.

* See Proceedings of the Ethnological Society.

Chambers, one of the reasons assigned by the Americans for not educating negro children along with white children, is, that after a certain age they "do not correspondingly advance in learning—their intellects being apparently incapable of being cultured beyond a particular point:" an allegation, which, though liable to the suspicion of partisan bias, so far accords with the independent statements previously quoted, as doubtless to have some basis. In all these cases, as also in the minor cases continually occurring among ourselves of inability to understand subjects and reasonings passing a certain order of abstruseness, the true interpretation is, that the cognitive faculties have not reached a complexity equal to the complexity of the relations to be perceived. Moreover, it is not only with purely intellectual cognitions that this holds; it holds also with what we distinguish as moral cognitions. In the Australian language there are no words answering to justice, sin, guilt. Among various of the lower races, acts of generosity or mercy are utterly incomprehensible. That is to say, the more complex relations of human action in its social bearings, are not cognizable. And thus, the large-brained European differs from the small-brained savage, not simply in the complexity of his manifestations, intellectual and moral; but these have been step by step made possible by successive complications of faculty.

Having, in the previous chapter, pointed out how greater length and higher degree of life, accompany increased speciality and increased generality of correspondences; it needs not to dwell on the fact that where both these unite in producing correspondences of increased complexity, the like result must happen. All that requires just indicating, is, that not only is this true of those more and more complex cognitions, which, through the medium of Science, advance the Arts; but it is true of those more complex moral cognitions, which, by making social order possible, contribute to that greater individual safety which social order brings.

CHAPTER XIII.

THE CO-ORDINATION OF CORRESPONDENCES.

§ 158. Fully to comprehend the increase of the correspondence between the organism and its environment, in speciality, in generality, and in complexity; it is requisite to contemplate the phenomena under yet another aspect. We must look at the general conditions by fulfilment of which these more elaborate adjustments of inner to outer relations are made possible. The performance of a compound action in response to a compound impression, implies something more than a susceptibility to each of the several elements constituting the compound impression, and a power to effect each of the several motions constituting the compound action. It implies also, that the constituent sensations and contractions shall be combined after a particular manner—shall be co-ordinated; and the perfection of the correspondence will vary as the perfection of the co-ordination.

Let us take first a simple case; as that of the actions needed for escape from an enemy. Clearly when we ascend from those creatures in which the motion of some conspicuous adjacent object is responded to simply by a few random muscular movements, to those creatures in which the muscular movements are such as to carry the body *away* from the dangerous object; we have advanced to an adjustment of at least two conjoined relations in the organism, to two conjoined relations in the environment. If we consider the strong visual impression produced by the adjacent moving object, to be the stimulus to activity; then, that the activity may be of the right kind, it is requisite that such particular modification of the impression as depends on the direction of the object in space, should also be recognized, and the activity modified in conformity to

it. The impression which indicates dangerousness, and that which indicates position, must together control the motor changes; and the control must consist in so ordering their respective amounts, that the composite result may be a movement of the organism in a particular line. When distance, as well as direction, becomes cognizable; and when the colour and shape of the object can be distinguished, as well as its mass; the stimulus must be composed of a much greater number of elements, united after a special manner: and in proportion as the consequent actions become more rapid, skilful, and varied, must there be a more elaborate and more perfect combination of motor changes. While just as a wrong combination of motor changes involves a fall or other accident; so, a wrong combination of the separate stimuli involves a mistaken perception.

Space need not be occupied in tracing up these simple kinds of co-ordination. It is obvious that throughout the whole series of increasingly heterogeneous impressions comprehended within the limits of immediate perception, including even the recognition of localities by an identification of the various surrounding objects, the component elements of the impressions co-operate after a particular manner; and that, as especially seen in this case of localities, it is only in virtue of a definite relationship among them, that a definite perception is possible. It is equally obvious, that the more and more complex actions by which higher creatures achieve their ends, succeed, only in as far as the muscular contractions implied, are fitly regulated in their order, their amounts, and their modes of conjunction. Both the directive and executive processes can become efficient, only in proportion to the accuracy with which they are co-ordinated.

§ 159. Advancing from these cases in which the directive stimuli, though heterogeneous, are made up of elements that are simultaneously present to the senses, to the cases in which some of their elements are present to the senses and some not;

we meet with a co-ordination of a new and higher order. And so likewise where the responding motions, no longer occurring in an inseparable group, are divided by intervals that vary according to circumstances, we see a parallel progress. A creature which, when pursued, flies to its burrow, or towards some distant unseen shelter, supplies us with an instance of the one; while an instance of the other occurs in any process, which, like the building of a nest, is effected by instalments variously interrupted by other procedures. From the stage in which a single past impression unites with many present ones to compose a special stimulus, and in which the action completed at intervals is tolerably homogeneous in character; the progression is gradually towards a union of many past impressions with present ones, and towards a species of action increasingly heterogeneous in its successive instalments, and in the manner of their succession. In the majority of men's daily proceedings, we see the sights, sounds, and muscular sensations, serving for immediate guidance, co-ordinated with recollections of the persons, places, things, events, to which those proceedings refer: and in such an error as that of mistaking the hour at which certain business is to be transacted with certain people at a certain office, we see how a failure arises from an imperfect co-ordination of the various past and present impressions constituting the directive stimulus. Further, in such a series of operations as those by which wheat is sown, weeded, reaped, stacked, thrashed, winnowed, taken to market, and sold; we see sundry widely different groups of actions (each consisting of many minor groups), divided by dissimilar and variable intervals, all adjusted to the achievement of a single end; and success requires that they shall be adjusted in a particular manner. Obviously the elaborateness displayed by these advanced cognitions and actions—in which time past, time present, and time future are alike involved; and which have simultaneous reference to sundry places in space,—is an elaborateness measured by the number of past impressions compounded with present ones. And obviously, throughout the

whole of this order of correspondences, the all-essential thing is, neither the multiplicity of the impressions received, nor the complexity of the combination into which they enter, but the definiteness with which that combination is adapted to the combination of external circumstances—the goodness of the co-ordination.

§ 160. A still higher species of co-ordination, growing imperceptibly out of the last, and vaguely seen even in the illustrations just given, involves not simply the union of past with present specialities, but the union of generalities with both. The impression received yesterday, when the barometer stood at "Fair;" together with the impression received to-day, when it stands at "Change;" have to be joined to the generalization that a fall of the mercurial column indicates rain; before any conclusion can be drawn for to-morrow's guidance. In other cases, as in that of a physician prescribing for his patient, several remembered observations of the bygone symptoms; several observations of the existing ones; and several general truths, serving to interpret the changes that have taken place; must all enter into that directive process which terminates in an appropriate course of treatment.

But the most developed form of co-ordination is that exhibited by quantitative science. In this, not only must many specialities be combined with many generalities after a perfectly definite manner; but there must be perfect definiteness in each constituent of the combination. The perceptions by which the data are obtained, must have their elements so exactly co-ordinated, as to give measured results. The laws of dependence must be so cognized, that they can be expressed numerically. And the process by which, out of data and laws, the prevision is finally evolved, must have each step united with preceding and succeeding ones, in a mode that is completely specific. A calculation of the capacity of a vessel which a given horse-power will move at a given speed, involves the general truths,—that the resistance encountered by a body moving through fluid varies in the square of the velo-

city; that the area opposed to the water varies as the squares of the dimensions of the vessel; that the tonnage varies as the cubes of the dimensions; with sundry others. Particular forces, weights, specific gravities, lengths, breadths, depths, have to be combined with these general truths, each with each; and the results have to be further combined after particular modes. If one of the generalities be applied to the wrong specialities — if the formula for resistance be brought to bear, not in the figures representing sectional area, but on those representing tonnage—if the data be inexact, or the principles be misunderstood, or the calculation be erroneously performed; that is—if there be an imperfect co-ordination of the various mental acts involved; a false result is reached: there is a failure in the act of cognition: the internal relations are not so adjusted as to match external ones. And here, indeed, is most distinctly shown the nature of this process by which all the more complex adaptations of the organism to its environment are effected. For this quantitative prevision, in the achievement of which the co-ordination of intellectual actions is so conspicuous, is, as we have already seen (§ 148), simply the highest form of correspondence—the correspondence that is the most complete, the most special, the last to make its appearance—the correspondence by which external phenomena are conformed to, not only in kind, but in time, place, amount, duration: and the perfect co-ordination by which this perfect precision of result is effected, is simply the final development of the co-ordination which has, to a greater or less degree, existed throughout. As perfect correspondence implies perfect co-ordination; so, each degree of correspondence implies a parallel degree of co-ordination.

It will further elucidate both this doctrine of co-ordination and the general doctrine of correspondence, if we consider how, for the perfect adjustment of inner to outer relations, there must necessarily exist in the first, elements and changes representing all the elements and changes in the last. The cognitions of exact science are distinguished from inferior cognitions in this; that the mental process involves a symbol answering

to every constituent of the phenomenon. Undeveloped life is guided by the associations among some of the superficial attributes of things. Developed life is guided by the relations subsisting among all those fundamental attributes on which the actions of the things depend. There is no invariable connection between a loud sound and an adjacent enemy; and hence, creatures in which one of these serves as an index to the other, are occasionally wrong in the adjustment of their internal relations to external ones. But the connection between linear dimensions and solid content, or between velocity and momentum, is of that constant, or, as we say, necessary nature, that, once known, it affords infallible guidance. For this infallible guidance to be had, however, requires that *all* the elements of the relation be cognized. Whenever a group of inner relations, a cognition, is completely conformed to a group of outer relations, a phenomenon, by a rational process — whenever there is what we call an *understanding* of the phenomenon; it is that the genesis of the phenomenon is, in a sense, paralleled by the genesis of the cognition: and that this may be possible, it is requisite that every component of the one process, be represented by some component of the other. The law, that the momentum of a moving body varies as its velocity multiplied into its weight, cannot be known until there exists in the mind, not only the conceptions answering to momentum, velocity, and weight; not only the processes of thought answering to those quantitative phenomena which "varies as" and "multiplied into" indicate; not only the ideas of matter, time, and space, without which velocity and momentum are inconceivable; but the law cannot be known until the states of consciousness symbolizing time and space, are so co-ordinated as to symbolize velocity; the states of consciousness symbolizing velocity and weight, so co-ordinated as to symbolize momentum; and these three again co-ordinated according to those laws of relation implied by "varies as" and "multiplied into." That is, every attribute of things which the phenomenon involves, must have its inter-

nal representative; and the several laws of dependence among these attributes, must be each represented by some constant relation among their representatives. This must be true of all those higher correspondences comprehended under quantitative prevision. Before the effect of any composition of causes in the environment can be exactly responded to, there must take place a parallel composition of changes in the organism — not parallel in the sense that there must be any likeness between the components of the two in complexity or sequence; but parallel in the sense that to every element or relation in the one, there must be an answering element or relation in the other. And this truth will be the more clearly realized on remembering, that if one of the elements or relations pass unrecognized, either from ignorance or mistake; or if there be any error in the reasoning or calculation—any flaw in the co-ordination; the predicted result does not agree with the real result: there is a failure in the correspondence.

These facts, while they afford a still more definite idea of that co-ordination of correspondences by which the more special and complex adjustments of the organism to its environment are effected, can scarcely fail to bring out into a yet clearer light, the general doctrine variously presented in the preceding chapters. That in these highest manifestations of Life which the culture of civilization has slowly produced—these quantitative previsions which alike imply such intense vital action, and so greatly subserve self-preservation by facilitating commerce and the arts—there should be so elaborate and complete a correspondence between the organism and the environment; serves as a crowning illustration of the truths, that life is the continuous adjustment of internal relations to external relations—the maintenance of a correspondence between them, and that the degree of life varies as the degree of correspondence. The many proofs which have been given that the life and the correspondence advance hand in hand, become doubly conclusive on finding that the two arrive at their climax together.

CHAPTER XIV.

THE INTEGRATION OF CORRESPONDENCES.

§ 161. Yet one more point of view remains, from which the phenomena of Life must be contemplated. It requires to be observed how, out of co-ordination there grows up integration —how compound impressions, as well as the compound motions guided by them, ever more and more approximate in their apparent character to simple impressions and simple motions—how the co-ordinated elements of any stimulus or act perpetually tend towards union, so as eventually to become distinguishable only by analysis—and how, further, the connection between stimulus and act, obeying the same law, becomes constantly closer, and ends in making them two sides of the same change.

It is by virtue of this law that the higher orders of correspondence become possible. In its absence, complex impressions could not generate complex actions with the needful rapidity; nor would there be time for that immense multiplicity of correspondences which advanced life displays. If the two organic changes which constitute sensation and motion, did not, in superior creatures, follow with greater rapidity than the withdrawal of a snail into its shell follows the touch of its horn, all those correspondences with the environment which imply any quickness of adjustment, would be impracticable. And if the period that elapses between the gaze of a young child at a stranger, and the fit of crying that follows it (a period during which the component visual impressions are being co-ordinated) were habitually paralleled in the perceptions of adult life—if compound cognitions were not formed,

and the appropriate operations produced by them, in periods incomparably briefer, human life would cease.

The necessity for this progressive integration of correspondences will be most clearly understood, if, regarding sensations as so many symbols, and perception as the interpretation of groups of symbols, we observe what takes place with verbal symbols and the meanings they convey: a comparison which is the more appropriate, inasmuch as the last process is but a higher form of the first. As in the lower phases of perception, a single sensation, as of scent, serves the organism as an index of the combined attributes with which such scent is connected; so, in the lower phases of language, a simple sound or sign is used to indicate a complex idea. In either case, within narrow limits, this system answers very well. But any considerable multiplication in the number of correspondences, requires another system. By scent, only some objects can be distinguished; seeing that many are scentless. Simple sounds and signs are too few in number to represent any considerable variety of ideas. Hence, in either case, a system of compound symbols becomes the prerequisite to any great extension of the correspondences. Things that are without odour, and things that are alike in odour, can be divided into sundry sub-classes, when impressions of colour and size, as well as of scent, can be appreciated. And when simple sounds are endlessly modified by articulations, and simple signs replaced by composite ones, it becomes possible verbally to indicate an infinity of objects, acts, qualities, &c. But now, what is the condition under which this more elaborate language becomes serviceable? Or, to confine the attention to one division of it:—What is required before composite written signs can supplant simple arbitrary ones? It is required that the constituent elements shall be so efficiently co-ordinated, so rapidly united in the act of perception, so integrated, as to become practically one. Had the letters that make up each word, to be separately identified, as the child identifies them when learning to read, the system would be of little or no use. Able though it might

be, by the varied combinations of its elementary signs, to express with precision all words whatever; it could never compete with the limited system of simple arbitrary signs, did it remain thus cumbrous in its application. Similarly with the primordial language of the sensations. If the several colours, size, shape, motion, distance, direction of a given object, had to be successively identified by the creature perceiving it—if the object had to be spelled out in this deliberate fashion; the method of recognition by combined sensations, would yield in utility to the limited method of recognition by a single sensation. Universal in its powers, it would yet be too slow of application to satisfy the requirements. In both cases, however, the progressive integration of the component correspondences removes this difficulty, by reducing, in effect, the compound signs to simple ones. A word made up of a dozen letters, comes eventually to be recognized as instantaneously as a single letter; while the host of impressions involved in the perception of a complex object, seemingly take no more time to receive and interpret than a single sound or taste. And thus there is an infinite gain in the speciality of the correspondences, without any loss in their rapidity. Let us glance at the results under some of their leading aspects.

§ 162. After the above explanations, it needs not to dwell upon the apparent simultaneity with which the outlines, lights and shades, and all the visible peculiarities with which bodies impress us, arouse those ideas of tangible extension, of resistance, of texture, with which experience has joined them; unless to point out how truly this is an integration of correspondences—how truly the visual sensations corresponding to a certain distance, the impressions of light and shade corresponding to a certain shape, the arrangement of lines corresponding to a certain solid extension, with many others, are so united as to seem one—so united that the entire group of sensations, and the inferences drawn from them,

appear to constitute but a single state of consciousness. Nor is it requisite to do more than just indicate the exceeding precision with which the most complex assemblages of these symbols are instantaneously distinguished from nearly identical assemblages; as seen in our ability to recognize by a single look, not only particular human beings, similar though they are in their chief attributes to most others, but even their particular mental states, trifling as are the outward modifications implying these. But while it is unnecessary to enlarge on these familiar facts, it may be well, for the purpose of conveying a vivid idea of the manner in which this integration of correspondences subserves the perceptions, just to describe an experiment by which its extreme strength and rapidity may be shown.

Our judgments of distance are guided by at least three separate indications. When the observed objects are known to us, the angles they subtend, or, rather, the spaces which their images cover upon the retina, aid in the estimate. The particular focal adjustments which the eyes must undergo to obtain distinct vision, and which are accompanied by certain muscular sensations, further assist. And the muscular sensations accompanying the due convergence of the visual axes, supply a third evidence. In all ordinary vision, these indications agree. But by that ingenious instrument of Professor Wheatstone's invention—the Pseudoscope—the last two are made to contradict each other. The muscular actions by which the visual axes are adjusted, being the more marked, and accompanied by the stronger sensations, give the preponderating evidence; and the result is, that when looked at through the Pseudoscope, convex objects seem concave, and concave ones convex. By particular management, however—that is, by adding to the evidence from focal adjustment some further evidence—the verdict of consciousness may be suddenly reversed. If, after contemplating the inside of a cup, and duly wondering at its apparent convexity, the cup be turned laterally little by little, so that the outside may

gradually come into view, and the opening grow more elliptical; there presently arrives a time when the perception all at once changes, and the cup is seen under its ordinary aspect. Now, the fact which it here concerns us to remark as so significant, is, the impossibility of any intermediate or hesitating judgment. Notwithstanding the conflict of evidence, there is, save just at the moment of change, a quite definite perception either of concavity or convexity. The perception is not incomplete or obscure, but perfectly distinct. The preponderating impressions, by forcibly exciting all those other impressions with which they are habitually connected, produce the same effect as though these other impressions were actually received, instead of the opposite ones being received. The co-ordinated sensations have become so inseparably integrated, that none of them can be present to consciousness without the whole group to which they belong being present. The entire perception, complex as it is in nature, is shown to be practically one.

With the executive, as well as with the directive processes, this integration takes place; and may be analogously illustrated. Any long-employed combination of muscular actions —any combination of which the elements never occur in any other arrangement, eventually becomes almost undecomposable. The tricks of walk, of attitude, of manual action, into which children fall, and of which it is so difficult to break them, furnish examples. The stammering which, commencing as it often does from imitation, becomes, when once established, next to incurable, owes its pertinacity to this tendency. So, too, is it with peculiarities of handwriting. The motions of the fingers, having by years of practice with the pen been co-ordinated after a particular fashion, cannot be otherwise co-ordinated without a degree of labour to which few are equal. Though, by moving them slowly and with attention, the muscles of the fingers may be made to produce differently-formed letters; yet, on the attention being relaxed, and the usual speed resumed, they re-assume their old character. Simi-

larly in all handicrafts, chains of perpetually-repeated muscular actions, however complex, eventually approximate in rapidity and ease, to simple motions; and, at the same time, become incapable of modified adjustment—tend more and more to produce each other automatically—grow inseparable—become integrated.

Not only between the elements of each cognition, and between the elements of each operation, does this connection grow ever more close; but also between cognitions and the operations guided by them. In the child learning to walk, or to direct its hand towards a neighbouring object, or to perform any manual act; there is a deliberate and conscious modification of the motions in obedience to the sensations. But in after-years, the various muscular adjustments by which, from minute to minute, the behests of the intellect are fulfilled, follow the will instantaneously, and without effort. While absorbed in gossip, the needle of the seamstress is carried through stitch after stitch, by a co-ordination of sensations and actions that has become next to instinctive. While deep in thought—"absent in mind," as the phrase is—the occurrence of particular perceptions will often be quite unconsciously followed by the habitual actions appropriate to them; sometimes with ludicrous effect. The start on one side, which is produced by a loud noise close at hand; the throwing out the arms in the endeavour to regain the balance after having slipped; these and many like phenomena, show us how directive and executive processes, originally quite distinct, come to be so united, that one follows the other not only instantaneously and without volition, but often without the possibility of prevention. Even where the impressions and motions are in the highest degree complex, the law may be traced; as in the feats of a skilful billiard-player. In one of his strokes, we see the distance, direction, relative positions of the balls to each other, to the cushions, and to the pockets, all united into a complex visual impression co-ordinated with the greatest nicety; we see the direction of the cue, its adjustment to the ball, the strength of

its impact, and the quality of its impact, all accurately modified to suit the requirements; and we see that by long habit, the compound impression has been so united with the compound action, that the one follows the other almost mechanically. No reasoning or calculation is required; or, indeed, is permissible. For it is notorious that in this, and like games of skill, any lengthened consideration, any hesitation, any anxiety, any active interference on the part of the higher mental faculties, almost inevitably causes a failure. The direct relation that has been established between the constituent sensations and motions, must be allowed free play; and success becomes sure in proportion as, by constant co-ordination, the combined changes have become practically one change.

In all which instances of the gradual consolidation of the elements of any habitual correspondence, we may perceive how that automatic character displayed in the simple correspondences of inferior creatures, tends to be gradually assumed by more complex correspondences—how that integration, which the reflex and purely instinctive correspondences perfectly exemplify, is partially exemplified by all higher correspondences, in the order of their ascending complication.

§ 163. But it is not only to the constituents of immediate perception, to the elements of composite motion, and to the combination of the two, that this law applies; it applies also to the highest processes of cognition. The most advanced abstractions of science, display it equally with the acquirement of manipulatory skill, or the power rapidly to recognize objects. For the act of making a generalization, is, in reality, an integration of the various separate cognitions which the generalization includes—is a union of them into a single cognition. After there has been a mental accumulation of phenomena presenting a certain community of nature—remembered first as isolated facts, and after further experience colligated as facts having some resemblance—there suddenly, on the occurrence perhaps of some typical example, arises a cognition of the

relation of coexistence or sequence common to the whole group: the particular facts, before but loosely aggregated, all at once crystallize into a general fact—are integrated. The mode, too, in which this result is brought about, is the same in these highest as in the lowest cases. As that continuous repetition of experiences in which any two sensations are always joined, any two muscular contractions constantly performed together, or any perception uniformly followed by a special motion, results in the greater or less integration of the component changes; so, the continuous repetition of those more complex experiences, which, though superficially unlike, one and all present the same fundamental relation of coexistence or sequence, ultimately results in establishing a union in thought between the elements of this relation: and this union, made ever stronger by still multiplying experiences, constitutes the generalization of them. Moreover, it will be obvious without details, that the same thing holds respecting the generalization of generalizations. Thus, the integration of correspondences is traceable from the simplest up to the most elaborate of the intellectual processes. And in the last, as in the first, the effect is so to simplify the complex directive and executive actions, as to render practicable, adjustments that would else fail from the elaborateness and slowness of the processes they involved. For as the perception of a complex object would mostly fail of its end, if it could be effected only by slowly spelling out the constituent sensations produced; so, any series of compound experiences, which, embodied into a generalization, afford valuable guidance, would be of little or no service if every member of the series had to be separately recollected before the guiding cognition could be formed.

§ 164. This gradual union of the elements of any internal change by which the organism adapts itself to an external coexistence or sequence—this process which may be almost described as the development of a special faculty for each special relation—has been, in common with previous ones, abundantly

displayed in the course of human advancement. Being a process through which only, highly special and complex correspondence can be achieved, progress in integration has been a necessary accompaniment of progress in speciality and complexity; and in proportion as civilization has displayed the last, it must have displayed the first. The one having been illustrated in detail, it is therefore needless to illustrate the other. Similarly, greater length and degree of life, involved as they are by greater complexity and speciality of correspondence, have accompanied that greater integration which has rendered these possible.

CHAPTER XV.

THE CORRESPONDENCES IN THEIR TOTALITY.

§ 165. Thus then we find variously illustrated in detail, the truth enunciated at the outset, that all vital phenomena are directly or indirectly in correspondence with phenomena in the environment. Whether the kind of Life contemplated be that embraced by Physiology, or that of which Psychology treats, it equally consists of internal changes that mediately or immediately conform to external coexistences and sequences. The assimilative processes going on in a plant, and the reasonings by which a man of science makes a discovery, alike exhibit the adjustment of inner relations to outer relations. That method by which we sought out the fundamental fact on which to base a Synthetic Psychology, is justified by its results. By comparing the phenomena of mind with the most nearly allied group of phenomena—those of bodily life—and inquiring what is common to both groups, a generalization was disclosed which we find on examination really does express the essential character of all mental actions. Regarded as they have been in the foregoing chapters, under every variety of aspect, the manifestations of intelligence are universally found to consist in the establishment of correspondences between relations in the organism and relations in the environment; and the entire development of intelligence is seen to be nothing else than the progress of such correspondences in Space, in Time, in Speciality, in Generality, in Complexity.

As hinted on more than one occasion, these various modes in which the advance of the correspondence displays itself, are but so many different aspects of one mode. The vast array of phenomena which, for convenience' sake, we have considered

under separate heads, form, in reality, one general, continuous, and inseparable evolution. The various orders of progress described, have not only been going on simultaneously, but have severally rendered each other possible. Each particular kind of advance has opened the way for advances of other kinds; and these again have reacted in like manner. All have been furthered by each: each has been furthered by all. Not only is it, as we saw, that the extension of the correspondence in Time, is at first rendered possible only by its extension in Space; but it is that ultimately, as in the researches of astronomers, its greatest extension in Space is achieved through its extension in Time. Not only is it that the progress of the correspondence in Time and Space involves an increase in its speciality; but it is that eventually, that immense increase in speciality implied by the making of telescopes and chronometers, gives a new progress to the correspondence in Time and Space. On the one hand, that advance in the complexity of the correspondence, which is seen in the ability to discriminate between objects that have many attributes in common, amounts to an advance in its speciality; and on the other hand, it is only through an advance in speciality, that greater complexity of correspondence can be reached. While, by the correspondence to higher and higher generalities, the way is opened for more complex and more special correspondences; it is only by accumulated experiences of such more complex and more special correspondences, that the correspondence to still higher generalities becomes possible. At both extremes of the evolution, this *consensus* among the various orders of correspondence is clearly traceable: the only difference being, that the further the development advances, the more intimate does the *consensus* become. If we contemplate the results of improved vision in some lowly member of the animal kingdom, we see that in addition to bringing within view a wider range of objects, and so extending the correspondence in Space; and in addition to giving earlier notice of the approach of prey or enemies, and so extending the correspond-

ence in Time; it entails a greater power discriminating among near objects, and so makes possible, correspondences of higher speciality. And if we consider what takes place in the man of science, from the adjustment of a further inner relation to some further outer relation—say the relation between an electric current and the magnetization of iron—we see, that while itself an advance in speciality of correspondence, it immediately leads to a great variety of advances in all orders of correspondence. By multiplication of experiments, it forthwith leads to a progress of the correspondence in generality—leads to an internal generalization corresponding to the general relation existing externally. It makes possible other generalities and specialities of correspondence to the phenomena of terrestrial magnetism. By disclosing the galvanometer, it not only establishes adjustments, both general and special, between inner relations and the outer relations subsisting among electrical phenomena of various orders; and not only does the same thing in respect to an immense range of chemical phenomena; but, through inquiries like those of Du Bois Reymond, it brings within range some of the phenomena of nervous and muscular action. Through the agency of the electric telegraph, which has also grown out of it, it makes possible, hosts of special correspondences between men's actions and the changes occurring at remote points on the earth's surface; it enables astronomers to ascertain the relative longitudes of observatories with the greatest nicety; and by supplying them with an improved means of registering meridional transits, it gives better data for calculating the distances and motions of the stars, for determining the structure of the nebula to which we belong, for ascertaining the motion of the sun in space, and for developing the grandest astronomical generalizations. These are but a few of the instances in which this one advance of the correspondence has facilitated other advances, of all orders and in all directions; and, in a greater or less degree, the same results happen from every other advance.

Thus, it will be manifest, that from the lowest to the highest forms of life, the increasing adjustment of inner to outer relations, is, if rightly understood, one indivisible progression. Just as, out of the homogeneous tissue with which every organism commences, there arises by one continuous process of differentiation and integration, a congeries of organs performing separate functions, but which remain throughout mutually dependent, and indeed grow more mutually dependent; so, the correspondence between the phenomena going on inside of the organism and those going on outside of it, beginning, as it does, with some simple homogeneous correspondence between internal and external affinities, gradually becomes differentiated into various orders of correspondences, which are constantly more and more subdivided, but which nevertheless maintain a reciprocity of aid that grows ever greater as the progression advances. The two progressions are in truth parts of the same progression. Not to dwell upon the facts which imply that the primordial tissue is endowed throughout with the several forms of irritability in which the senses originate, and that the organs of sense arise, like all other organs, by the differentiation of this primordial tissue; not to dwell upon the fact that the impressions received by these senses form the raw materials of intelligence, which arises by combination of them, and must therefore conform to their law of evolution; not to dwell upon the fact that intelligence advances *pari passu* with the advance of the nervous system, and that the nervous system obeys the same law of development as the other systems; not to dwell upon these facts, it is sufficiently manifest, that as the progress of organization and the progress of the correspondence between the organism and its environment, are but different aspects of the evolution of Life in general, they cannot fail to harmonize. And hence, in this organization of experiences which we call Intelligence, there must be that same continuity, that same subdivision of function, that same mutual dependence, and that same ever-advancing *consensus*, which characterize the physical organization. The correspondence between the organism and

its environment, while becoming in each higher phase more specialized and heterogeneous, must ever remain, as it has been from the beginning, one and indivisible.

§ 166. We find then, that whether, as in preceding chapters, the facts are examined in detail, or whether, as here, they are contemplated in their ensemble, they necessitate the conclusion that, fundamentally considered, Intelligence has neither distinct grades, nor is constituted of faculties that are truly independent; but that its highest phenomena are the effects of a complication that has arisen by insensible steps out of the simplest elements. Every form of Intelligence being, in essence, an adjustment of inner to outer relations; it results that as, in the advance of this adjustment, the outer relations increase in number, in complexity, in heterogeneity, by degrees that cannot be marked; there can be no valid demarcations between the successive phases of Intelligence. The space through which the correspondence gradually extends, has no definite boundary up to which a certain order of mind is competent, but beyond which another order is required. No precise length of time can be named, as the greatest to which the actions can be adjusted by one supposed species of guiding principle. Among the degrees of speciality in the correspondence, it is impossible to fix on that which can be reached, but not passed, by any denomination of mental endowment. And similarly under whatever aspect the phenomena are regarded. Evidently then, the classifications current in our philosophies of the mind, can be but superficially true. Instinct, Reason, Perception, Conception, Memory, Imagination, Feeling, Will, &c., &c., can be nothing more than either conventional groupings of the correspondences; or subordinate divisions among the various operations which are instrumental in effecting the correspondences. However widely contrasted they may seem, these various forms of intelligence cannot be anything else than either particular modes in which the adjustment of inner to outer relations is achieved; or particular parts of the process of adjustment.

It is doubtless true that there are perceivable distinctions between the phenomena grouped under these different heads. But when considered in their essentials, it becomes manifest that, as contemplated from one point of view, they merge into each other as branches into one trunk; and that, as contemplated from another point of view, they are but the different constituents of which each more complex correspondence is made up. All the facts are comprehended under the generalization that has been enunciated. The entire range of phenomena which Psychology embraces, comes within this formula which unites them with those of Physiology.

§ 167. Nevertheless, as the two kinds of Life treated of under the respective heads of Physiology and Psychology, though primordially the same, are yet in their general aspects widely unlike; it behoves us to inquire whence arise the differences between them. The various modes of intelligence known as Instinct, Memory, Reason, Feeling, Will, and the rest, having, in spite of their community of nature, specific distinctions; it remains to be determined in what these consist. If, as above alleged, the several grades of mind, and its component faculties, are phases of the correspondence; they can be interpreted as such: and to complete the argument it is needful that they should be so interpreted. We have now, then, to enter upon another department of our subject. Closing here the General Synthesis, and carrying with us the fundamental truth evolved by it, it remains to found upon that fundamental truth a Special Synthesis.

PART IV.

SPECIAL SYNTHESIS.

CHAPTER I.

THE NATURE OF INTELLIGENCE.

§ 168. The two great classes of vital phenomena which Physiology and Psychology respectively embrace, are broadly distinguished in this; that while the one class includes both simultaneous and successive changes, the other includes successive changes only. While the phenomena forming the subject-matter of Physiology, exhibit themselves as an immense number of different series bound up together; those forming the subject-matter of Psychology, exhibit themselves as but a single series. The briefest consideration of the many continuous actions constituting the life of the body at large, suffices to show that they are synchronous—that digestion, circulation, respiration, excretion, secretion, &c., in all their many subdivisions, are going on at one time, in mutual dependence. And the briefest introspection serves to make it clear, that the actions constituting thought, occur, not together, but one after another. Should a rigorous criticism demand qualifications of this statement, they cannot be such as to diminish its general truth. Life being the definite combination of heterogeneous changes, both simultaneous and successive, in correspondence with external coexistences and sequences; the two great divisions of life must ever be distinguished as, the one a correspondence that is both simultaneous and successive, and the other a correspondence that is successive only.

At first sight, this may be supposed to constitute an impassable distinction between the two. Such, however, is by no means the fact. Even were the highest psychical life thus *absolutely* distinguished from physical life, which we shall presently see reason to doubt, it would still be true that

psychical life, in its earlier and lower phases, is not thus distinguished; but that the distinction arises, only in the course of that progression by which life in general attains to its more perfect forms. That gradual differentiation and integration, seen alike in the evolution of organic structures, and in the evolution of the correspondence between their actions and those in the environment, is also seen in the separation of that correspondence into its two great orders. At the same time that through it have resulted the various subordinate divisions of the correspondence, through it also, has resulted this fundamental division. Originally, the particular kinds of change forming the germ of psychical life, were, like those out of which physical life arises, both simultaneous and successive; and it is but by slow steps that they have come to be distinguishable as successive only. Let us glance at a few of the facts.

Passing over the creatures moved by cilia, in which the independence of the constituent irritations and motions simultaneously going on, is manifest—passing over the zoophytes, in which each part of the organism is capable, in a greater or less degree, of stimulations and contractions apart from the rest, which may at the same moment be responding to other stimuli —passing over these lowest creatures, in which the absence, or rudimentary character, of the nervous system, forbids anything like community of impressions throughout the mass; let us consider what happens even when the nervous system has attained some development. In the higher *Radiata*, as, for example, the star-fish, each of the several like divisions of which the body consists, "is connected with a ganglionic centre, that seems to be subservient to the functions of its own division alone, and to have little communication with, or dependence upon, the remainder."* The result is, that the sensory and motor actions going on in each ray of a star-fish, are, in the main, independent of those going on in the others. Such elementary psychical changes as the creature manifests, take place simultaneously in different parts of its body; each part sepa-

* Carpenter's "Principles of Comparative Physiology." Fourth edition, p. 654.

rately responding to the impressions made upon it. And hence the fact, that for a length of time after being divided from each other, the rays severally continue to exhibit their ordinary actions. Though in the *Mollusca,* there is no such repetition of like parts having similar endowments; yet it is held, that the ganglia distributed through the body, are in great measure independent in their actions, or have these actions but very imperfectly co-ordinated into any general psychical life.* In the *Articulata,* whose structure specially fits them for the experiment, this dispersion of the psychical life may be very clearly shown. "The *Mantis religiosa* customarily places itself in a curious position, especially when threatened or attacked, resting upon its two posterior pairs of legs, and elevating its thorax with the anterior pair, which are armed with powerful claws: now if the anterior segment of the thorax, with its attached members, be removed, the posterior part of the body will still remain balanced upon the four legs which belong to it, resisting any attempts to overthrow it, recovering its position when disturbed, and performing the same agitated movements of the wings and elytra as when the unmutilated insect is irritated; on the other hand, the detached portion of the thorax, which contains a ganglion, will, when separated from the head, set in motion its long arms, and impress their hooks on the fingers which hold it.—If the head of a *Centipede* be cut off, whilst it is in motion, the body will continue to move onwards by the action of the legs; and the same will take place in the separate parts, if the body be divided into several distinct portions. * * * * If the body be opposed in its progress by an obstacle of not more than half of its own height, it mounts over it, and moves directly onwards, as in its natural state; but if the obstacle be equal to its own height, its progress is arrested, and the cut extremity of the body remains forced up against the opposing substance, *the legs still continuing to move.*—If, again, the nervous cord of a Centipede be divided in the middle of the trunk, so that the hinder legs

* Carpenter's "Principles of Comparative Physiology," p. 658.

are cut off from connection with the cephalia ganglia, they will continue to move, but not in harmony with those of the fore part of the body; being completely paralyzed so far as the animal's controlling power is concerned; though still capable of performing reflex movements by the influence of their own ganglia, which may thus continue to propel the body in opposition to the determinations of the animal itself."* From all which facts we see, that in one of these articulated creatures, the actions which pertain to the psychical division of the life, are in great measure performed independently and simultaneously by the several segments. Just as, in the structure, is provided a separate ganglion to each segment; so, in the function, each segment exhibits a more or less distinct nervous activity. The impression made upon each leg by the surface touched, is conveyed to the special ganglion of that leg, and thence reflected upon a muscle moving in the leg; and only in its power of setting agoing or arresting this automatic action, has the creature's chief nervous centre any participation in the process. So that, even in animals of this comparatively advanced organization, both orders of vital changes are simultaneous and successive: the differentiation of the psychical from the physical life is but slight. Even in the Vertebrata this differentiation is by no means complete. A large part of the actions that appear voluntary, are in a great degree automatic, and may be performed without consciousness. "Infants are sometimes born without any Cerebrum or Cerebellum; and such have existed for several hours or even days, breathing, crying, sucking, and performing various other movements. The Cerebrum and Cerebellum have been experimentally removed from Birds and young Mammalia, thus reducing these beings to a similar condition; and all their vital operations have, nevertheless, been so regularly performed as to enable them to live for weeks, or even months."† The ordinary experiments on decapitated frogs, clearly show the reflex origin of many muscular actions.

* Carpenter's "Principles of Comparative Physiology," p. 665.

† Ditto, p. 686.

"It is certain that, in Birds, the movements of flight may be performed after the removal of the Cerebrum."* Nay, even in the adult human being, there are many actions belonging to the psychical division, which either may or may not enter into the current of consciousness. The motion of the legs is necessarily accompanied with various muscular and tactual changes. These, together with the state of feeling constituting volition, may be distinctly present to consciousness—may be thought of as by a child learning to walk; or they may, as in ordinary walking, be wholly left out of consciousness. The various impressions received by the feet; the various feelings of muscular tension; the various combinations of sensations and contractions by which the equilibrium is maintained; may be all going on while consciousness is entirely absorbed in some interesting train of thought—may form an independent series of changes parallel to those going on in consciousness—may form, as it were, a kind of secondary consciousness, subordinate to the primary one. The processes we perform while eating display a very similar relation. The several acts by which each morsel is selected, cut, prepared, and carried to the mouth, may perhaps be held to enter into the current of our thoughts; though in general, and especially during conversation, they seem next to unconscious. But many of the impressions and motions involved are certainly unconscious. The sensations which the knife-handle gives; the contractions by which it is grasped; and the muscular changes which the arms are every moment undergoing, scarcely ever, if at all, occupy the attention. That is to say:—Out of a great number of psychical actions going on in the organism, only a part are woven into the thread of consciousness; while the others form one or more distinct strands, which, as it were, occasionally inosculate with the thread of consciousness, but do not permanently unite with it. The like is manifestly to a great extent true in speaking and writing. And the reader can, doubtless, call to mind occasions on which some habitually performed process, even of

* Carpenter's "Principles of Comparative Physiology," p. 689.

considerable complexity, was performed quite unthinkingly, and while—to use the common phrase—he "did not know what he was about."

Contemplating, then, these typical facts, it will be manifest that the differentiation by virtue of which the changes constituting psychical life, have become successive only, instead of simultaneous and successive, has arisen by degrees, and has not even now become complete. In the lowest animal types, each part of the organism, while it performs by and for itself all other vital functions, also responds by and for itself to external stimuli; and the psychical changes, or what stand for them, are both simultaneous and successive to almost as great an extent as the physical ones. Gradually as a nervous system makes its appearance, these psychical changes become slightly co-ordinated—have their various strands connected. Gradually as the nervous system becomes more and more integrated, the twisting of these various strands of changes into one thread of changes grows more complete. But to the last their union never becomes entire. The vital actions constituting the subject-matter of Psychology, while distinguished from other vital actions by their tendency to assume the form of a single series, never *absolutely* attain that form.

§ 169. The gradual rise of this distinction between the psychical and the physical life, will be most clearly understood, if we consider the mode in which it first appears, and the leading stages of its progress.

Throughout the homogeneous tissue of which the lowest creatures consist, there is complete community of actions. Each part does what the other parts do. The several vital processes are going on simultaneously in many places alike. These primordial organisms, if organisms they can be called, exhibit no differentiation of either structure or function. And thus, the two great divisions of life, as well as the various subdivisions of each, are, in the beginning, one.

The first great differentiation established, is that between the

inner and outer tissues—the mass, and its limiting membrane —the substance of the body, and its skin. The parts of the originally uniform jelly, are subject to but one marked contrast of conditions—that between contact with each other, and contact with the environment. The external portions are bathed by the surrounding medium: the internal portions are not. And in response to this primary contrast of conditions, there eventually arises a contrast of structure and function. That which is permanently outermost, takes on the modified form of vital action which its circumstances demand: that which is permanently innermost, similarly assumes a more specialized order of activity. And with this differentiation of function there goes on a simultaneous differentiation of structure.

Primarily, the division of labour thus commenced may be considered as physiological only. In virtue of its position, the surface may be regarded as necessarily assuming the duties of absorption—the taking in of water, and nutriment, and oxygen. And when, by the involution of the surface, a stomach comes to be formed, the change may be understood as a further separation of duties, such that nutrition is chiefly confined to one part of the limiting membrane and aeration to another. But the advance is not solely an advance in the physiological division of labour: it is at the same time an advance towards the separation of psychical actions from physical ones; and is even a first step towards bringing the psychical actions into a serial order. As a necessary result of its position, the skin not only permanently assumes the office of taking in the matters by which the processes of integration and disintegration may be maintained, and of excreting the effete products; but it also permanently assumes the office of receiving all those impressions which form the raw material of intelligence. The mechanical and other actions going on in the environment, can be responded to by the organism, only when it is affected by them; and any effect they produce upon it must be proximately experienced by its surface. The skin, then, being the part immediately subject to the various kinds of external stimuli, neces-

sarily becomes the part in which psychical changes are originated. That adjustment of inner to outer relations in which intelligence of all degrees consists, must in every case be initiated by the actions of things upon the outside of the organism. Any consequent movement of the organism entails further actions of things upon its outside. And hence, as contrasted with the contained substance, the skin comes to be more especially concerned in such psychical changes as arise; and more and more definitely so, as the differentiation becomes more complete. But now mark the implication. The changes constituting the physical life, continue, as before, to go on simultaneously throughout the entire mass. Those which foreshadow the psychical life, are, in an increasing degree, localized in its outer surface—belong to the outer surface primarily, and affect some other parts secondarily. Though, as soon as there is any rudiment of a nervous system, impressions received by the skin are followed by specific changes elsewhere; yet, as these specific changes elsewhere, would not have occurred without the impressions on the skin, we must consider these as fundamental. So that, contemplating the facts under their general aspect, we may say that while the physical changes pervade a *solid*, the psychical ones, or rather those out of which psychical ones arise, tend to be confined to a *surface*. And as the changes that can be simultaneously going on throughout a solid, are infinitely greater in number than those to which a surface can be subject; it results that, even by this primary differentiation, the incipient psychical life comes to be distinguished from the purely physical life, by the diminished quantity of simultaneous changes that it may include.

At succeeding stages in the progression, further differentiations, having like natures and results, are clearly traceable. At first, this sensitiveness, which forms the basis of the psychical life, is diffused more or less equably over the whole surface; but it presently becomes in some degree concentrated. Though, in general, all parts of the skin remain impressible by touch; yet certain parts, which are by their positions more especially

liable to receive tactual impressions, become more highly susceptible than the rest; and in these parts the great majority of the sensorial changes are localized. That is to say, the changes forming the raw material of intelligence, by being in a great measure restricted in the area of their occurrence, have the characteristic of simultaneity still further limited; and the more highly developed the tactual apparatus, the more marked is the limitation.

Still more decisive is this limitation rendered by the development of the special senses. The olfactory and gustatory sensations are localized in smaller tracts than the sensation of touch; and each of these tracts is little, if at all, capable of undergoing more than one change at one time. Visual and aural impressions are receivable only within yet narrower areas; and even the two areas susceptible of each, become functionally one. The ears are simultaneously affected by the same sounds; and in the higher creatures the eyes, being so placed as to converge their axes on the same object, are occupied with almost identical images, and yield to consciousness what seems to be one impression. Nay, even of the sensations occurring within the narrow space of each retina, a further concentration is manifest. The highest sensitiveness of the retina is confined to a very minute spot; and the changes to which that spot is subject, so dominate over the others as greatly to obscure them. If we further call to mind that when the most advanced intelligence is reached, the sensational changes that arise in the nose and the palate are but occasional; and that those proceeding from the eyes and ears are by far the most frequent; it will be seen to what extremely small portions of the organism the changes which form the greater part of the raw material of intelligence, are ultimately confined.

This continued process of differentiation and integration—by which the changes forming the substance of psychical life, are first gradually concentrated upon the surface of the organism; afterwards upon certain regions of that surface;

afterwards upon those most specialized parts of it constituting the organs of the higher senses; and in the most perfect of these are even more or less localized in minute centres; will clearly show how the psychical life grows distinct from the physical life, by the increasing tendency of its changes to assume the serial arrangement. We have nothing to do with the progressive development of the nervous system, and the actions that are carried on throughout its mass. All these actions originate in the senses. The internal changes are consequent upon the external ones. And just in proportion as the external ones tend towards the serial form, the consequent internal ones must do the same. Evidently, then, this distinction is involved in the very progress of the sensitive organization.

§ 170. But now, from our present point of view, the matter will be more fully comprehended on observing, that the advance of the correspondence of itself necessitates a growing seriality in the psychical changes; or in other words—that the advance of the correspondence, the development of consciousness, and the increasing tendency towards a linear order in the psychical changes, are different aspects of the same progression.

For how only can the constituent changes involved in any complex correspondence be co-ordinated? Those abilities which an intelligent creature possesses, of recognizing a variety of external objects of different structures, and of adjusting its actions to composite phenomena of many kinds, imply a power of combining many separate impressions. These separate impressions are received by the senses—by different parts of the body. If they go no further than the points at which they are made, they are useless. Or if only some of them are brought into relation with each other, they are useless. That an adjustment may be effected, they must be all brought into relation with each other. But for them all to be brought into relation with each other, implies some centre of communication

common to them all. They cannot possibly be co-ordinated without this. This centre of communication common to all the impressions, must be one through which they severally pass; and as they cannot pass through it simultaneously, they must necessarily pass through it in succession. Just in proportion as the external phenomena responded to become greater in number, and more complicated in kind, must the variety and rapidity of the changes to which this common centre of communication is subject, increase—just in this proportion must there result an unbroken series of these changes —just in this proportion must there arise a consciousness.

Hence then it is manifest, that the progress of the correspondence between the organism and its environment, inevitably involves a more and more complete reduction of the sensorial changes to a succession; and by so doing inevitably involves the evolution of a consciousness—a consciousness that becomes higher and higher as the succession becomes more rapid and the correspondence more complete.

§ 171. This doctrine, that mental phenomena constitute a series, is one of very old standing; and one the general truth of which none call in question. As we have seen, however, it requires to be understood in a somewhat qualified sense. Where, as above, the facts are contemplated objectively, it becomes manifest that though the changes constituting intelligence approach more or less nearly to a single succession, they do not absolutely form one—that there are constantly being performed actions of an intelligent kind which are not present to consciousness—and that, through the many gradations between the completely conscious actions and the completely unconscious ones, the psychical changes merge into those which we distinguish as physical, and the boundaries of the series are blurred. When we go on to consider the facts subjectively—when we interrogate consciousness, we still find that though the seriality of the changes becomes yet more clearly manifest, there are nevertheless certain experiences

which make us hesitate to assert this seriality in any very rigorous sense.

Thus, the visual impressions which we are every moment receiving, though ordinarily regarded as single states, are yet in reality compound ones; and it becomes a perplexing question whether each of these compound states can, strictly speaking, be a member of a linear series of changes. It is not simply that the various distances, solidities, structures, &c., which appear to be immediately given in each impression, are really known by inference, and severally imply many changes; but it is that the various objects included within the visual field, are simultaneously present to consciousness with various degrees of distinctness—produce what may in some sense be called simultaneous changes in consciousness. Besides the particular thing to which the eyes are directed, many other things are seen more or less clearly; and no lines of demarcation can be drawn between either the degrees of perfection with which they are impressed upon the retina, or those with which they are presented to consciousness. Only one particular point of the object looked at, is perceived with perfect distinctness. Yet it cannot be said that consciousness is wholly occupied with this one point; for the object itself becomes known by the single glance directed to the one point. Obviously the degree of consciousness which we have of things within the visible area, becomes insensibly less as they become more remote from the centre to which the axes of the eyes converge. Obviously there is no particular distance from it at which we can say that consciousness ceases. And thus there would seem to be a great number of nascent consciousnesses, of different intensities, existing at the same moment. Still more manifest will become the difficulty of regarding this visually-produced consciousness as single, when it is remembered that each of these nascent consciousnesses is really the result of a distinct change, or group of changes, in the retina. The immense number of separate sensitive agents of which the retina consists, being severally capable of independent stimu-

lation, it results that when a cluster of images is cast upon them, they are one and all affected in various modes and degrees. They simultaneously undergo a variety of changes, which are more or less distinctly presented to consciousness. Evidently, then, it is only by a certain license that the internal change produced by any visual impression can be called single. It is in reality a multitude of simultaneous changes bound together. The thread of consciousness is made up of an immense number of separate strands; and it is only in the sense that these separate strands are more or less united, that consciousness can be said to consist of a succession of changes.

Nevertheless, the truth of the general doctrine that the psychical life is distinguished from the physical life by presenting successive changes only, instead of successive and simultaneous changes, may be even further shown from the very facts here cited. For though, when subject to a visual impression, we become nascently conscious of many things; yet, there is always some one thing of which we are conscious in a higher degree than the rest. And beyond this, it is observable that when we so direct our attention to any one thing as to perceive it in the true sense of the word—to know it as such or such, we are almost exclusively occupied with that one thing, or some particular part of that one thing. Though the images of other objects are all the while being impressed upon the retina, and are producing changes there; yet these appear to produce extremely little internal effect—are scarcely more than physical changes—do not undergo that co-ordination with others which is required to constitute them psychical changes. And this fact, that in proportion as any object, or part of an object, seen, is distinctly thought of, the other objects within view cease to be thought of, shows very clearly how consciousness becomes more definitely serial as it rises to a higher form. So that, reverting to the metaphor before used, we may say that while the outer strands of changes which constitute the thread of consciousness, are indefinite and loosely adherent,

there is always an internal closely-twisted series of changes, forming what we may consider as consciousness proper.

Thus, though a critical examination of the facts, shows that the seriality of psychical changes can be asserted only in a qualified sense, it shows that, if not absolutely so distinguished from physical changes, they are relatively so distinguished; and it shows, that in proportion as the psychical changes assume that more perfect form constituting consciousness proper, they become so distinctly serial, as to originate what we recognize to be a single succession of states. Though these may be physiologically composite, and were once psychologically so; yet, to the extent that they have become consolidated elements of thought, they may rightly be regarded as severally simple.

And here indeed, where the question is considered in relation to the human consciousness only, it is resolvable by the briefest introspection. No controversies respecting the nature of our mental states, can alter our inward perception that consciousness cannot be in two states at one time—that any one state of consciousness necessarily excludes any other. However difficult it may be to say where one state of consciousness ends and another begins—however difficult it may be to say respecting certain states of consciousness, whether they are simple or complex; the fact remains the same, that the states of consciousness are serial. If any state, commonly regarded as one, is asserted to be made up of many states; then, those many occur in succession. If they do not occur in succession, they must occur together; and must so form one state. These are the only alternatives. And whichever be chosen, it remains equally manifest that, subjectively considered, the changes in consciousness constitute a linear series.

§ 172. Concerning the nature of Intelligence, therefore, we reach the conclusion, that it consists of a certain order of changes, which are distinguished from that lower order of

changes constituting bodily life, by the peculiarity, that, instead of being both simultaneous and successive, they are successive only. Step by step differentiated from the lower order of changes with which they are originally one; they assume a more completely serial arrangement in proportion as intelligence advances. Though this serial arrangement never becomes in all respects absolute; yet, in the human consciousness, it becomes almost so: and the highest processes of this consciousness are possible on no other condition. The simple fact that every distinct proposition expresses a relation, and that every relation subsists between two terms, of itself proves that distinct thought cannot exist except as a single succession of states. And hence, the seriality of its changes must be regarded as that especial characteristic of intelligence, which approaches to absoluteness as the intelligence approaches to perfection.

A continued series of changes being thus the subject-matter of Psychology, it is the business of Psychology to determine the law of their succession. That they do not occur at random, is manifest. That they follow one another in a particular way, the existence of Intelligence itself testifies. The problem then, is, to explain their order.

CHAPTER II.

THE LAW OF INTELLIGENCE.

§ 173. All Life, whether physical or psychical, being the combination of changes in correspondence with external coexistences and sequences; it results, that if the changes constituting psychical life, or intelligence, occur in succession, the law of their succession must be the law of their correspondence. That particular kind of Life which we distinguish as intelligence, including as it does the various developments of the correspondence in Space, in Time, in Speciality, in Complexity, &c.; it necessarily follows that the changes of which this intelligence consists, must, in their general mode of co-ordination, harmonize with the co-ordination of phenomena in the environment. The life is the correspondence; the progress of the life is the progress of the correspondence; the cessation of the life is the cessation of the correspondence: and hence, if there is one particular department of the life, which, more manifestly than any other, consists in the constant maintenance of the correspondence; the changes which make up this highest department of life, must, more manifestly than any other, display the correspondence. The fundamental condition of vitality, is, that the internal order shall be continually adjusted to the external order. If the internal order is altogether unrelated to the external order, there can be no adaptation between the actions going on in the organism and those going on in its environment: and life becomes impossible. If the relation of the internal order to the external order, is one of but partial adjustment; the adaptation of inner to outer actions is imperfect: and the life is proportionately low and brief. If, between the inner and the outer order, the adjustment is complete; the adaptation is complete:

and the life is proportionately high and prolonged. Necessarily, then, the order of the states of consciousness is in correspondence with the order of phenomena in the environment. This is an *à priori* condition of intelligence.

Clear, however, as it is, that from this *à priori* condition of intelligence, must result the law of succession of psychical changes, an adequate expression of such law is by no means easy to find. Did the phenomena in the environment form, like the phenomena of consciousness, a succession; there would be no difficulty. The entire fact would be expressed by saying that the internal succession parallels the external succession. But the environment contains a great number of successions of phenomena, going on simultaneously. Further, the environment contains a great variety of phenomena that are not successive at all, but coexistent. Yet again, the environment is unlimited in extent, and the phenomena it contains are not only infinite in number, but insensibly pass into a relative non-existence, as the distance from the organism increases. And yet once more, the environment, relatively considered, is ever varying as the organism moves from place to place in it. How, then, can the succession of psychical changes be in any way formulated? How is it possible to express the law of a single series of internal phenomena, in terms of its correspondence with an infinity of external phenomena, both serial and non-serial, mixed in the most heterogeneous manner, and presented to the moving organism in an endless variety of fortuitous combinations?

Were it not that the inner relations *must* be in correspondence with the outer ones; and that therefore the order of the states of consciousness *must* be in some way expressible in terms of the external order; we might almost despair of finding any general law of psychical changes. Even as it is, we may be certain that any such general law cannot apply to extended portions of the series of changes. Dependent as these must in great measure be, upon the heterogeneous combinations of phenomena by which the organism is at any

moment environed, and upon the new heterogeneous combinations perpetually disclosed by its movements, they can be no more formulated than the heterogeneous combinations of external phenomena can be formulated. Evidently, therefore, it must be in the constituent changes, and small groups of changes, rather than in the longer concatenations of changes, that we must look for a law.

And this is the indication given by certain still more general considerations. As on each particular link in a chain, depend the succeeding links; so, on each particular change in consciousness, depend all the succeeding changes: and hence the law of the succession of changes, must be really involved in the law of the individual change. If there occurs in consciousness a change from state A to state F, there will follow certain changes F to L, L to D, D to K, &c.; but if the first change had been from A to D, some other series of changes, D to J, J to C, C to N, would have resulted. So that, as the particular combination of subsequent changes is ever dependent upon the change occurring at each moment; and as each of these subsequent changes becomes, when it occurs, the change on which those succeeding it depend; it follows that the law of the individual change is the sole thing to be determined.

Not simply, therefore, as being the only phenomenon in the mental succession which there is any hope of formulating; but as being the phenomenon on which all other phenomena in the mental succession must hinge; the subject of our inquiry must be—the law of the connection between any two successive states of consciousness—the law of the elementary psychical change.

§ 174. Using the expression *state of consciousness*, in its most extended sense, as meaning the psychical state of any order of creature, and also as meaning any species of psychical state, from the most simple to the most complex; the law of the connection between any two successive states of con-

sciousness, will become manifest on considering the *à priori* necessity to which it must conform. Each of the two states originally answers to some particular phenomenon external to consciousness. Every external phenomenon exists in certain relations to other phenomena. Hence, a correspondence between the internal order and the external order, implies that the relation between any two states of consciousness, corresponds with the relation between the two external phenomena producing them. How corresponds? The two states of consciousness occur in succession: and all successions are alike in so far as they are simply successions. In what, then, can the correspondence consist? It consists in this; that the *persistency* of the connection between the two states of consciousness, is proportionate to the *persistency* of the connection between the phenomena to which they answer. The relations between external phenomena are of all grades, from the absolutely necessary to the purely fortuitous. The relations between the answering states of consciousness must similarly be of all grades, from the absolutely necessary to the purely fortuitous. And as the correspondence becomes more complete, that is—as the intelligence becomes higher, the various grades of the one must be more and more accurately paralleled by those of the other. When any state *a* occurs, the tendency of some other state *d*, to follow it, must be strong or weak according to the degree of persistency with which A and D (the objects or attributes that produce *a* and *d*) occur together in the environment. If, in the environment, there is a more persistent occurrence of A with B than of A with D; then, the maintenance of the correspondence implies, that when *a* arises in consciousness, *b* shall follow rather than *d*. If there are in the environment a great variety of things in connection with which A occurs; then, when the state of consciousness *a*, arises, it must be followed by the state of consciousness answering to the thing most generally occurring along with A. These are manifest necessities. If the strengths of the connections between the internal states, are not proportionate to

the persistencies of the relations between the answering external phenomena; there must be a failure of the correspondence — the inner order must disagree with the outer order. Psychical life, in common with life in general, being the continuous adjustment of inner to outer relations; and the occurrence of any relation between states of consciousness, being, in itself, nothing else than an exhibition of the fact, that the cohesion of the antecedent and consequent states was greater than the cohesion between the antecedent state and any other state; it follows inevitably, that, to effect the adjustment, the cohesion of the states must vary as the cohesion of the phenomena represented by them. The law of intelligence, therefore, is, that the strength of the tendency which the antecedent of any psychical change has to be followed by its consequent, is proportionate to the persistency of the union between the external things they symbolize.

To say, however, that this is the law of intelligence, is by no means to say that it is conformed to by any intelligence with which we are acquainted. It is the law of intelligence in the abstract; and is conformed to by existing intelligences in degrees more or less imperfect. To the extent that psychical changes fulfil this law, to such extent only do they constitute intelligence; and it is but very incompletely that even the highest orders of psychical changes do this. A due understanding of the matter will, however, be best obtained, by examining the several objections to this general statement which suggest themselves.

§ 175. Beyond doubt, if we contemplate the acts of the animal creation in general, we find endless instances in which the internal order entirely fails to parallel the external order. It is clear that in a moth which flies at the candle-flame, there exists no relation of psychical states answering to the relation between light and heat in the environment. The relation between the odour of a flower and the contained honey, is duly responded to by sequent actions in the moth; as is

also the relation between a certain change in the visual field, and the approach of a living body. But there is no internal adjustment by which, after the visual impression produced by a flame, anything analogous to the feeling of a burn is suggested; and hence the creature's death. Again, the birds which, on uninhabited islands, allow explorers to approach close to them, manifestly lack that co-ordination of psychical changes by which the birds of our woods and moors are led to fly the sportsman. Externally, there coexists with particular visible appearances, a destructive activity; but internally, the state of consciousness produced by these visible appearances, is not followed by any state of consciousness representing a destructive activity: and a risk of being killed is the consequence. In the mind of a child, the state produced by the sight of some brightly-coloured berry, does not suggest any state representative of pain, or of the word "poison;" but more probably, some representation of a pleasant taste; and should certain injurious chemical properties coexist with these attractive visible ones, the child's life may be endangered. But in all cases of this kind, in which the order of psychical changes is totally at variance with the order of external phenomena, what is the implication? Do we not speak of them as resulting from lack of sagacity? or as evincing ignorance? And is it not a corollary, that as the non-conformity of the inner to the outer order is want of intelligence, the conformity of the inner to the outer order is that in which intelligence, abstractedly considered, consists?

Yet more manifest will the truth of this conclusion become, if we look at a few instances in which the failure of the correspondence is not total, but partial. In the great majority of cases, the dog that comes on hearing his name called, does so in the expectation of finding his master, or some member of the family; but if, as occasionally happens, his name is called by a stranger, the sequence in his states of consciousness, and his consequent actions, are not adapted to the external facts; or, as we say, he makes a mistake. Among the Aus-

tralian savages, who, in their natural state, mostly meet with violent deaths, it is the belief that any one who dies without a visible cause has been killed by an unseen enemy; and a stranger who happens to be found near at hand, runs a great risk of being sacrificed as the supposed assassin. Here, though the mental succession very generally agrees with the succession of phenomena in the environment, it by no means uniformly does so. The Laplanders again, finding, as they do, a constant relation between hot weather and the continuance of the sun above the horizon during the night, doubtless have an established connection in thought between these phenomena — a connection which, however completely it may answer to the external connection in that limited part of the environment known to them, does not answer to the ordinary external connection. The earlier chemists, in virtue of a large number of experiences respecting the combinations of acids and bases, came habitually to think of substances that neutralized bases, as substances having sour tastes; but this sequence of the ideas—ability to neutralize a base, and the possession of a sour taste—though very generally in harmony with external relations, is not so in all cases.

What, now, are the terms we use respecting instances like these, in which the inner order does not completely answer to the outer order? We regard them as indicating a low degree of intellect; or as showing a limited experience; or as the results of but a partial enlightenment. And the disappearance of these discrepancies between thoughts and facts, we regard as an advance of intelligence.

It is abundantly clear, then, that to whatever extent the order of psychical changes does not conform to the order of the environing phenomena, to that extent there is a lack of intelligence. And hence it follows, that the law in the fulfilment of which the conformity consists, may properly be called the law of intelligence.

§ 176. The greatest apparent obstacle to the establishment

of this law, is that presented by the phenomena of coexistence. In so far as the environment presents motions and changes, there is no difficulty in understanding it to be the law of intelligence, that the strength of the tendency which the antecedent of any psychical change has to be followed by its consequent is proportionate to the persistency of the union between the external things they symbolize. But when the union between the external things they symbolize is not a union of successive phenomena, but a union of simultaneous phenomena —not a union in Time, but a union in Space—not a sequence, but a coexistence; then, it becomes less easy to see how the parallelism between the inner and the outer order can result from the fulfilment of this law. The connection between two states of consciousness occurring in succession, can very well represent the connection between two external phenomena occurring in succession. But if it can do this, it cannot also represent the connection between two external phenomena *not* occurring in succession. Whence it follows, that in so far as environing coexistences are concerned, the correspondence cannot be effected by any change in consciousness conforming to the alleged law of intelligence.

The reply to this objection is, by implication, contained in a foregoing chapter, on "The Relations of Coexistence and Non-Coexistence." It is there shown, *à posteriori*, that the relation of coexistence is known as a doubled sequence—a sequence whose terms follow one another through consciousness in either order, with equal facility and vividness; and it is pointed out that, even *à priori*, we might conclude, that as consciousness can exist only by a succession of changes, an external no-change can be presented in consciousness only by a change that is immediately reversed—only by a progression that is instantly followed by an equivalent retrogression —only by a duplication in consciousness, made up of a sequence and its inversion. Such being the nature of the relation of coexistence, subjectively considered, the law of intelligence as above formulated, applies to it as fully as to

the relation of sequence. If any two phenomena, A and B, habitually coexist in the environment; then, when the phenomenon A is presented to the senses, the induced state of consciousness, *a*, is immediately succeeded by the state *b*, representing the phenomenon B. The process of thought does not end here, however: if it did, the external relation would be known as a sequence. But the phenomenon B, in the environment, being as much the antecedent of A as A is of B (neither of them ever being either antecedent or consequent, otherwise than in the order of our experience of them), it results that the state *b* having been induced, the law involves that it shall be followed by the state *a*. The state *a* again induces the state *b*, and is itself once more re-induced; and so on, as long as the relation remains the object of thought. To render the matter the clearer, let us take a case. If, in the light, the visible outlines and colours of a body are presented, the resulting state of consciousness is instantly followed by the consciousness of something resistant; and conversely, if, in the dark, a body is touched, the resulting state of consciousness is instantly followed by the consciousness of something extended. But in neither case is this all. When the consciousness of resistance has suggested that of extension, the consciousness of extension is not followed by some third consciousness of another kind. Were it so, the object would cease to be thought of. But, as we all know, when the idea of extension has been suggested, that of resistance does not finally disappear; nor when the idea of resistance has been suggested, does that of extension finally disappear. Both continue to be thought of, as it would seem, almost simultaneously. And seeing that the two terms of the relation, extension and resistance, cannot be cognized in absolutely the same state of consciousness; seeing, further, that the persistent consciousness of them cannot be one state of consciousness, which is equivalent to no consciousness; it follows, that the apparently incessant presentation of both, is really a rapid alternation—an alternation so rapid as to produce

the effect of continuity: just as the alternating light and darkness to which each part of the retina is subjected while watching a torch whirled round, produce the impression of a circle of fire; or just as the alternations experienced by the ear-drum, when receiving a succession of separate pulses, constitute a uniform sensation of sound. And, indeed, these considerations render it sufficiently clear, that only in virtue of the law of intelligence as above formulated, does the relation of coexistence become cognizable. For this great rapidity with which the two states of consciousness, answering to two coexistent phenomena, continually reproduce each other, itself exemplifies the extreme cohesion of those internal states which correspond to extremely coherent external phenomena. And it is in consequence of this extreme cohesion, and the rapid alternation involved by it, that the two phenomena are presented apparently together, and the idea of coexistence generated.

When it is further remarked, that where, as in most cases, there are not two coexistent phenomena but a group, this same law implies a like cohesion of a number of different states of consciousness, which must similarly produce and reproduce each other in all orders; and when it is remarked that such an irregularly varied presentation and representation of combined properties, is just what we know takes place, the conformity of the facts to the alleged law will be rendered yet more apparent. And even still more apparent will it become on remembering, that whereas such of the states of consciousness as answer to invariably coexistent phenomena, as resistance and extension, continue reproducing each other during the whole perception, forming, as it were, the basis of it; the several other states of consciousness answering to the special qualities of the object—qualities not invariably coexisting with resistance and extension—do not remain thus persistent, but appear, and disappear, and reappear in consciousness, with degrees of frequency varying more or less according to the constancy of the answering qualities.

§ 177. A fact which at first sight may be thought to conflict with the generalization to be established, is, that a great proportion of the changes in consciousness arise after a fashion that is in one sense fortuitous. A succession of noises heard through the open window, traverses consciousness in a totally irregular manner, of which no account can be given beyond describing it. When walking through the streets, the passing people and vehicles produce internal changes of which the succession is indeterminate. Though, on receiving certain visual impressions, there result in the mind the changes constituting the perception of a man; and though, in so far, the order of the changes is determinate; yet, the occurrence of these impressions and the consequent perception, the moment after there had arisen some thought concerning the weather or the last news, is a fact which would appear unconformable to any law of psychical changes. Moreover, it may be objected, that not only are very many of the changes which occur in the state of consciousness from minute to minute, accidental, but that the order of the series of states, even in some of its largest features, is accidental. A mere chance may determine a man to go abroad or remain at home; to commence a new occupation, or continue an old one; to marry, or remain a bachelor; and the character of the whole series of his subsequent states of consciousness may thus be modified. Nor is it only of the changes constituting the human consciousness that this is true: it is more or less true of all grades of psychical changes. No matter what the degree of its intelligence, every creature is subject to impressions between which no internal law of connection can be traced. And hence, to a large part of the successive changes of which intelligence in general consists, the formula above given would seem to be inapplicable.

This difficulty, insurmountable as it looks, will disappear when the formula is interpreted in its most general sense; and it will be perceived that these, in one respect, fortuitous changes, really conform to the law of intelligence. The law is,

that the strength of the tendency which the antecedent of any psychical change has to be followed by its consequent, is proportionate to the persistency of the union between the external things they symbolize. Thus far, we have considered this law with more especial reference to those connections in consciousness which correspond to established connections in the environment: we have dealt with it as a generalization of the facts commonly grouped under the head of "association of ideas." Here, however, the connections in the environment to which the connections in consciousness correspond, are not established connections, but accidental ones. A fortuitous relation in the environment, is paralleled by a fortuitous relation in thought. Two adjacent states of consciousness answer to two phenomena that are adjacent in Space or Time. Thus far the law manifestly applies as before. The internal order conforms to the external order. But how, it may be asked, can the *tendency* of the antecedent state of consciousness to be followed by the consequent state, be described as *proportionate* to the persistency of the *union* between the external things they symbolize? Very properly. Suppose the relation in the environment to be that between a certain individual and some unusual place at which he is met. This relation may either be considered generally, in connection with our average experiences; or specially, as a particular experience. Generally considered, the relation is one whose terms have no persistency of union whatever; seeing that this individual may never have been in that place before, and may never be in it again: and in conformity with this total absence of persistency in the external union, is the total absence of any general tendency for the consciousness of that individual and the consciousness of that place, to follow one another—at any rate before he was met there. Specially considered, the relation is one that actually occurred; and when it occurred, the union between its terms was absolute—there was for the time being an absolutely persistent union between the place and the person—a union that was absolutely persistent in the sense that for the moment

it was indissoluble, and its occurrence thenceforth became an unalterable fact: and in conformity with this temporarily absolute coexistence, is the temporarily absolute tendency of the answering states of consciousness to follow one another. As, for the time being, the adjacent coexistence was as absolute as that of extension and resistance; so, for the time being, the cohesion between the two states of consciousness was as absolute as that between the conceptions of extension and resistance. And as, generally, there is no such adjacent coexistence; so, generally, there is no such tendency for the two states of consciousness to occur in juxtaposition. Thus, rightly interpreted, the law applies as fully to the relations presented in any act of perception, even when they are fortuitous, as it does to those relations which an accumulated experience establishes among the ideas.

§ 178. In the succession of psychical changes, there doubtless occur many combinations which are not readily to be accounted for on the hypothesis that the strength of the tendency which the antecedent of any psychical change has to be followed by its consequent, is proportionate to the persistency of the union between the external things they symbolize. Thus, respecting the case last instanced, it may be remarked, that though before a certain person has been met in a certain place, there exists no tendency whatever for the states of consciousness answering to the place and the person to occur together; yet, afterwards, there will often be a very decided tendency for one of the states to call up the other—a tendency so decided that it may show itself on many successive occasions. Whence it would appear, that in such cases, a more persistent relation is established between the states of consciousness than existed between corresponding phenomena. Moreover it is observable, that in many cases, the extremely exceptional character of the external relation, becomes the very cause of tenacity in the internal relation: the more astonishing the event—the more utterly it is at variance with the ordinary course of nature, the stronger becomes the cohesion between the answer-

ing states of consciousness. Whence it would appear that in some instances, psychical changes obey a law the very reverse of that enunciated. And again, it may be asked, how, if the law is as alleged, can consciousness ever escape out of certain indissolubly related states when once it gets into them? If, for instance, the necessary relation of coexistence between extension and resistance, is known through the rapid alternation of the states of consciousness answering to them; if these states are as inseparable in the organism as the phenomena in the environment; and if there is no other state so closely coherent to either as each is to the other; why should not the two go on reproducing each other for ever?

Fully to answer these and all like queries, would be to include in this chapter an entire system of psychology; seeing that when all the peculiarities of the succession of psychical changes are explained, everything is explained. Here none but general replies can be given. Of these the first is, that, as already said, the law enunciated is the law of intelligence in the abstract; not the law of our intelligence, or of any intelligence with which we are acquainted. It is the law to which psychical changes tend more and more completely to conform, as the intelligence becomes higher; but which can be perfectly conformed to only by a perfect intelligence. And a little consideration of the anomalies will render it manifest, that many of them imply nothing beyond imperfection in the conformity. But in the great majority of cases, it will, I believe, be found, that what seem to be nonconformities, are really conformities of a complex kind. It must be remembered that the succession of any one state of consciousness after any other, is the result, not of any single tendency, but of a combination of tendencies. As, in the environment, each phenomenon stands related not to one other, but to many others; as the relations in which it stands to these many others are some of them necessary, some very general, some special, some purely fortuitous; it follows that in fulfilment of the law of intelligence, each state of consciousness has connections, more or less close, with many

other states—has a number of other states simultaneously tending with various degrees of strength, to arise after it. The consequence is, that the change which actually takes place, is the *resultant* of many tendencies acting together. The new state of consciousness produced, is produced by a composition of forces. The particular force with which the new state cohered to its antecedent, is aided by the forces with which a group of allied states cohered to it; and by the union of a number of small forces, a tendency may be produced which overcomes some single tendency much stronger than any one or two of them. It is just as with the great physical law of the external world. Simple as is the principle that every atom of matter attracts every other with a force varying inversely as the square of the distance; yet, we see in the still unsolved "problem of three bodies," how complex becomes the effect when several forces are in action; and how, when a number of bodies are involved, the course that will be pursued by any one of them becomes altogether incalculable. Similarly, though the law of attraction of mental states is simple; yet, when the attractions of a number of mental states are operating at the same moment—some uniting, some conflicting—it becomes next to impossible to determine the specific result. And just as in the ascent of a balloon, we may meet with a phenomenon seemingly quite at variance with the law of gravitation, though really quite in harmony with it; so, there may occur mental changes which, while they appear to be directly opposed to the law of psychical succession, are nevertheless fulfilments of it.

Joining with this general explanation of minor anomalies, the previous interpretations of the law in its leading applications, it can no longer be doubted that the strength of the tendency which the antecedent of any psychical change has to be followed by its consequent, is proportionate to the persistency of the union between the external things they symbolize. This is the *à priori* necessity: and this is the generalization reached *à posteriori*. Only in virtue of this law can there be that adjustment of internal to external relations, without which

life is impossible: and only on the supposition of such a law can we explain the facts, that relations which are absolute in the environment are absolute in us; that relations which are probable in the environment are probable in us; that relations which are fortuitous in the environment are fortuitous in us. Unquestionably, therefore, this law is the law of intelligence.

CHAPTER III.

THE GROWTH OF INTELLIGENCE.

§ 179. The law enunciated in the foregoing chapter, being the law of Intelligence in the abstract—the law which Intelligence tends more and more completely to fulfil the further it advances, we have next to examine the several modes in which the more complete fulfilment of this law is exhibited; and to inquire whether there is any general cause for an ever-increasing fulfilment of it.

Commencing with some lowly-endowed creature, respecting which it can be scarcely at all said, that the strength of the tendency which the antecedent of any psychical change has to be followed by its consequent, is proportionate to the persistency of the union between the external things they symbolize; we may note three several modes in which the progression shows itself. There is, first—increase in the *accuracy* with which the inner tendencies are proportioned to the outer persistencies. There is, second—increase in the *number* of cases, differing as to kind but like as to grade of complexity, in which there are inner tendencies answering to outer persistencies. And there is, third—increase in the *complexity* of the coherent states of consciousness, answering to coherent complexities in the environment. The organism is placed amidst an infinity of relations of all orders. It begins by imperfectly adjusting its actions to a few of the very simplest of these. To adjust its actions more exactly to these few simplest, is one form of advance. To adjust its actions to more and more of these simplest, is another form of advance. To adjust its actions to successive grades of the more complicated, is yet another form of advance. And to whatever stage it reaches, there are still the same three kinds of progression open to it—a per-

fecting of the correspondences already achieved; an achievement of other correspondences of the same order; and an achievement of correspondences of a higher order: all of them implying further fulfilment of the law of intelligence.

But now, what are the conditions to these several kinds of progression? Is the genesis of Intelligence explicable on any one general principle applying at once to all these modes of advance? And if so, what is this general principle?

§ 180. As, in the environment, there exist relations of all orders of persistency, from the absolute to the fortuitous; it follows that in an intelligence displaying any high degree of correspondence, there must exist all grades of strength in the connections between states of consciousness. As a high intelligence is only thus possible, it is manifestly a condition of intelligence in general, that the antecedents and consequents of psychical changes shall admit of all degrees of cohesion. And the fundamental question to be determined, is:—How are these various degrees of cohesion adjusted?

Concerning their adjustment, there appear to be but two possible hypotheses, of which all other hypotheses can be but variations. It may on the one hand be asserted, that the strength of the tendency which each particular state of consciousness has to follow any other, is fixed beforehand by a Creator—that there is a pre-established harmony between the inner and outer relations. On the other hand it may be asserted, that the strength of the tendency which each particular state of consciousness has to follow any other, depends upon the frequency with which the two have been connected in experience—that the harmony between the inner and outer relations, arises from the fact, that the outer relations produce the inner relations. Let us briefly examine these two hypotheses.

The first receives an apparent support from the phenomena of reflex action and instinct; as also from those mental phenomena on which are based the doctrine of "forms of

thought." But should these phenomena be otherwise explicable, the hypothesis must be regarded as altogether gratuitous. Of criticisms upon it, the first that may be passed, is, that it has not a single fact to rest upon. These facts that may be cited in its favour, are simply facts which we have not yet found a way to explain; and this alleged explanation of them as due to a pre-established harmony, is simply a disguised mode of shelving them as inexplicable. The theory is much upon a par with that which assigns, as the cause of any unusual phenomenon, "an interposition of Providence;" and the evidence for the one is just as illusive as that for the other. A further criticism is, that even those who lean towards this theory dare not apply it beyond a narrow range of cases. It is only where the connections between psychical states are absolute—as in the so-called forms of thought, and the instinctive actions—that they fall back upon pre-established harmony. But if we assume that the adjustment of inner relations to outer relations, has been in some cases fixed beforehand, we ought in consistency to assume that it has been in all cases fixed beforehand. If, answering to each absolutely persistent connection of phenomena in the environment, there has been provided some absolutely persistent connection between states of consciousness; why, where the outer connection is almost absolutely persistent, and the inner connection proportionately persistent, must we not suppose a special provision here also? why must we not suppose special provisions for all the infinitely varied degrees of persistency? The hypothesis, if adopted at all, should be adopted in full. The consistent adoption of it, however, is declined, for sundry very obvious reasons. It would involve the assertion of a rigorous necessity in all thought and action—an assertion to which those leaning towards this hypothesis, are, more than any others, opposed. It would imply that at birth there is just as great a power of thinking, and of thinking correctly, as at any subsequent period. It would imply that men are equally wise concerning things of which they have had no experience, as concerning

things of which they have had experience. It would altogether negative the fact, that those who have had a limited and exceptional experience come to erroneous conclusions. It would altogether negative that advance in enlightenment which characterizes human progression. In short, not only is it entirely without foundation in our positive knowledge of mental phenomena; but it necessitates the rejection of all such positive knowledge of mental phenomena as we have acquired.

While, for the first hypothesis, there is no evidence, for the second the evidence is overwhelming. The multitudinous facts commonly cited to illustrate the doctrine of association of ideas, support it. It is in harmony with the general truth, that from the ignorance of the infant the ascent is by slow steps to the knowledge of the adult. All theories and all methods of education take it for granted—are alike based on the belief that the more frequently states of consciousness are made to follow one another in a certain order, the stronger becomes their tendency to suggest one another in that order. The infinitely various phenomena of habit, are so many illustrations of the same law: and in the common sayings — "Practice makes perfect," and "Habit is second nature," we see how long-established and universal is the conviction that such a law exists. We see such a law exemplified in the fact, that men who, from being differently circumstanced, have had different experiences, reach different generalizations; and in the fact that an erroneous connection of ideas will become as firmly established as a correct one, if the external relation to which it answers has been as often repeated. It is in harmony with the familiar truths, that phenomena altogether unrelated in our experience, we have no tendency to think of together; that where a certain phenomenon has within our experience occurred in many relations, we think of it as most likely to recur in the relation in which it has most frequently occurred; that where we have had many agreeing experiences of a certain relation, we come to have a strong belief in that relation; that where a certain relation has been daily experienced throughout our whole lives,

with scarcely an exception, it becomes extremely difficult for us to conceive it as otherwise—to break the connection between the states of consciousness representing it; and that where a relation has been perpetually repeated in our experience with absolute uniformity, we are entirely disabled from conceiving the negation of it—it becomes absolutely impossible for us to break the connection between the answering states of consciousness.

The only orders of psychical sequence which do not obviously come within this general law, are those which we class as reflex and instinctive—those which are as well performed on the first occasion as ever afterwards—those which are apparently established antecedent to experience. But there are not wanting facts which indicate that, rightly interpreted, the law covers all these cases too. Though it is manifest that reflex and instinctive sequences are not determined by the experiences of the *individual* organism manifesting them; yet there still remains the hypothesis that they are determined by the experiences of the *race* of organisms forming its ancestry, which by infinite repetition in countless successive generations have established these sequences as organic relations: and all the facts that are accessible to us, go to support this hypothesis. Hereditary transmission, displayed alike in all the plants we cultivate, in all the animals we breed, and in the human race, applies not only to physical but to psychical peculiarities. It is not simply that a modified form of constitution produced by new habits of life, is bequeathed to future generations; but it is that the modified nervous tendencies produced by such new habits of life, are also bequeathed: and if the new habits of life become permanent, the tendencies become permanent. This is illustrated in every creature respecting which we have the requisite experience, from man downwards. Though, among the families of a civilized society, the changes of occupation and habit from generation to generation, and the intermarriage of families having different occupations and habits, very greatly confuse the evidence of psychical transmission; yet, it needs but to consider national characters, in which these disturbing

causes are averaged, to see distinctly, that mental peculiarities produced by habit become hereditary. We know that there are warlike, peaceful, nomadic, maritime, hunting, commercial races—races that are independent or slavish, active or slothful, —races that display great varieties of disposition; we know that many of these, if not all, have a common origin; and hence there can be no question that these varieties of disposition, which have a more or less evident relation to habits of life, have been gradually induced and established in successive generations, and have become organic. That is to say, the tendencies to certain combinations of psychical changes have become organic. In the domesticated animals, parallel facts are familiar to all. Not only the forms and constitutions, but the habits, of horses, oxen, sheep, pigs, fowls, have become different from what they were in their wild state. In the various breeds of dogs, all of them according to the test of species derived from one stock, the varieties of mental character and faculty permanently established by mode of life, are numerous; and the several tendencies are spontaneously manifested. A young pointer will point at a covey the first time he is taken afield. A retriever brought up abroad, has been remarked to fulfil his duty without instruction. And in such cases the implication is, that there is a bequeathed tendency for the psychical changes to take place in a special way. Even from the conduct of untamed creatures, we may gather some evidence having like implications. The birds of inhabited countries are far more difficult to approach than those of uninhabited ones. And the manifest inference is, that continued experience of human enmity has produced an organic effect upon them —has modified their instincts—has modified the connections among their psychical states.

Thus then, of the two hypotheses, the first is supported by no positive evidence whatever; while the second is supported by all the positive evidence we can obtain. That the inner cohesions of psychical states are pre-adjusted to the outer persistencies of the relations symbolized, is a supposition which,

if taken in its full meaning, involves absurdities so many and great that none dare carry it beyond a limited range of cases. That it is the true supposition in so far as this limited range of cases is concerned, no single piece of direct evidence can be given; seeing that only to one present at the creation of an organism is knowledge of pre-adjustment possible. So far as the facts are accessible, the supposition is so utterly untenable that no one entertains it; and so far as it is entertained, the facts are inaccessible and must ever remain so. On the other hand, the supposition that the inner cohesions are adjusted to the outer persistencies by an accumulated experience of those outer persistencies, is in harmony with all our positive knowledge of mental phenomena. It is a supposition that is confirmed by three separate methods of inductive inquiry. By the Method of Agreement; inasmuch as we have countless cases of states of consciousness whose cohesion is found to follow a repeated experience of the related phenomena to which they answer. By the Method of Difference; inasmuch as we have countless cases in which persons in other respects agreeing, differ in the cohesion between certain of these states of consciousness, as much as they have differed in their experiences of the answering phenomena. By the Method of Concomitant Variations; inasmuch as the degree of cohesion between states of consciousness, is found, other things equal, to vary as the number of times which the external relation to which they correspond has been repeated in experience. So conclusive, indeed, is the proof of this experience-hypothesis, that in respect to the great mass of psychical phenomena, no one doubts it. Only in respect to a particular order of psychical phenomena is the adverse hypothesis maintained. And though in so far as reflex actions and instincts are concerned, the experience-hypothesis seems to fail; yet, it is to be remembered that its seeming failure occurs only where the facts fail; and that in so far as the facts are accessible, they point to the conclusion that even automatic psychical connections result from the registration of experiences continued for numberless generations.

Such is the conclusion here adopted. The doctrine that the connections among our ideas are determined by experience, must, in consistency, be extended not only to all the connections established by the accumulated experiences of every individual, but to all those established by the accumulated experiences of every race. The abstract law of Intelligence being, that the strength of the tendency which the antecedent of any psychical change has to be followed by its consequent, is proportionate to the persistency of the union between the external things they symbolize; it becomes the resulting law of all concrete intelligences, that the strength of the tendency for such consequent to follow its antecedent, is, other things equal, proportionate to the number of times it has thus followed in experience. The harmony of the inner tendencies and the outer persistencies, is, in all its complications, explicable on the single principle that the outer persistencies produce the inner tendencies. Let it be granted that when two psychical states have once occurred in immediate succession, there results a certain tendency for the first, when it afterwards recurs, to be followed by the second—a proposition supported by an infinity of evidence; let it be granted that on every subsequent recurrence of this succession, a like effect is produced, and that by the accumulation of these effects the tendency becomes ever stronger—a proposition also supported by an infinity of evidence; let it be granted that this accumulation of effects goes on without limit, so as ultimately to make the tendency, as it must, insuperable—a proposition which is an unavoidable corollary from the previous one, and which is supported by all the facts accessible to us; let this be granted, and the adjustment of inner to outer relations is entirely explicable on the experience-hypothesis. All psychical relations save the absolutely indissoluble, are allowed on every hand to be determined by experience. Their various strengths are admitted by every one to be proportionate to the multiplication of experiences. It is an unavoidable corollary that an infinity of experiences will produce a psychical relation that is absolutely indissoluble.

Though such infinity of experiences cannot be received by a single individual, yet it may be received by the countless succession of individuals forming a race. The individuals forming a race, severally transmit the constitutions they receive, with such modifications as their own habits of life produce in them. We have more or less distinct evidence, that induced tendencies in the nervous system, are transmitted along with induced tendencies in the other systems. And if we draw the induction, that the transmission of induced tendencies in the nervous system is a general law, we may conclude that all psychical relations whatever, from the absolutely indissoluble to the fortuitous, are produced by experiences of the corresponding external relations; and are so brought into harmony with them.

Thus interpreting the facts then, the inference is, that the growth of intelligence in general, like its growth in every individual, is dependent on the single law, that when any two psychical states occur in immediate succession, an effect is produced such that if the first subsequently recurs, there is a certain tendency for the second to follow it.

§ 181. From this law, if it be the true one, must be deducible all the phenomena of unfolding intelligence, from its lowest to its highest grades. Let us first observe how far the leading deductions correspond with the leading facts.

If the tendency of psychical states to follow one another results from their having before followed one another; and if each new succession in the same order adds an increment to this tendency; and if repeated successions in this order are consequent upon repeated experiences of the answering external relations; it follows that the psychical relations in any organism, must grow into correspondence with the particular class of environing relations with which it comes most in contact. The environment in general is infinite. The environment of each order of creature is practically more or less limited. And each order of creature has an environment which,

besides being limited, is practically more or less special. The law implies then, that the psychical relations displayed by each order of creature, will be those which are most frequently repeated within the range of its experience. And this we know to be the fact.

Contemplating the animal kingdom at large, the first psychical relations established, must be those answering to the most prevalent environing relations of the simplest kind; which is just what we find. The stationary polype with outstretched tentacles, contracts on being touched. Now a creature that is not itself moving, can be touched only by something in motion. And this universal relation between collision and some moving body, is one of the first to be responded to. When a shadow passing across a rudimentary eye, is followed by a movement in the creature possessing that eye, the internal relation between the impression and the motion, corresponds with the relation between a passing opacity and a passing solidity in the environment; and this is one of the most general relations. Various other analogous cases will suggest themselves.

In the progress of life and in the progress of the individual, the adjustment of the inner tendencies to the outer persistencies, must begin with the simple and advance to the more and more complex; seeing that both within and without, the complex relations are made up of the simple ones, and cannot be established before the simple ones have been established. After some persistent relation of A to B in the environment, has, through accumulated experiences, generated a persistent relation between the psychical states *a* and *b*; and after some other persistent outer relation of C to D, has similarly generated a persistent inner relation *c* to *d*; then, if in the environment there exists any relation between the relations A to B and C to D, it becomes possible for repeated experiences to generate in the organism, a relation between *a* to *b* and *c* to *d*. But it is manifestly impossible for this to be done until the relations *a* to *b* and *c* to *d* have been themselves generated. This de-

duction too, we see to be in complete conformity with the facts, both of individual and of general evolution.

Further, it must follow, that the only thing required for the establishment of a new internal relation answering to a new external one, is, that the organism shall be sufficiently advanced to cognize the two terms of such new relation, and that being thus advanced, it shall be placed in circumstances in which it shall experience this new relation. Here also, there is a manifest harmony between the *à priori* inference, and the inference from observation. In our domestic animals there are constantly formed new psychical relations answering to such new external relations as have terms sufficiently simple to be cognized. And in human civilization we see the truth illustrated in the progress to wider and wider generalizations.

But the validity of these several corollaries will become more apparent as we proceed. That the phenomena of intelligence are all deducible from the one general truth, that when any two psychical states occur in immediate succession, an effect is produced such that if the first subsequently recurs there is a certain tendency for the second to follow—a tendency to which every repetition of the succession adds a further tendency—will be most clearly seen on tracing out the growth of intelligence under its chief aspects. Let us now pass on to these.

CHAPTER IV.

REFLEX ACTION.

§ 182. Under its simplest and most general form, Reflex Action is the sequence of a single contraction upon a single irritation. A vague manifestation of this sequence marks the dawn of sensitive life. Omitting those which lie on the border line of the two kingdoms, animal organisms are broadly distinguished from vegetable organisms by the peculiarity that they move on being touched, or otherwise impressed. Even the almost structureless ones, respond in a more or less decided way to external excitements; and it is mostly in consequence of their response that they are concluded to be alive. But though, in the movements of these lowest creatures, reflex action is foreshadowed, it is only when we ascend to those in which there exists something like a nervo-muscular apparatus, that reflex-action proper is exhibited. In these, the response is effected not through the agency of the one uniform tissue constituting the creature's body, which is at once irritable and contractile; but the irritability is confined to one specialized tissue (nerve), and the contractility to another specialized tissue (muscle); and the two are placed in such relation that the irritation of the one is followed by the contraction of the other. Some impression is made upon the peripheral termination of a nerve; this impression is propagated along the nerve until it reaches a ganglion; there some action is set up which is propagated along another nerve proceeding from the ganglion to a muscle; and thus the stimulus carried through an afferent nerve to some inner centre of communication, is *reflected* from it through an efferent nerve to the contractile agent. In this simplest form of psychical action,

we see a single internal relation adjusted to a single external one. Any one of the many suckers on the arm of a cuttle fish that has been separated from the body, will, under the influence of its own independent ganglion, attach itself to a substance placed in contact with it—the established or organized relation between the tactual and muscular changes in the sucker, is parallel to the uniform relation between resistance and extension in its environment—the inner cohesion of psychical states, is as absolutely persistent as is the outer relation between the attributes. And if we remember that in the daily actions of the creature, this inner relation is perpetually being repeated in response to outer one; we see how the organization of it in the species, answers to the infinitude of such experiences received by the species.

§ 183. Reflex action being the lowest form of psychical life, is, by implication, that which is most nearly related to the physical life—that in which we see the incipient differentiation of the psychical from the physical life. This truth may be discerned from several different points of view.

It was pointed out that, in all probability, the contraction seen in the lowest animal organisms when they are touched, or otherwise stimulated, is the result of an increased vital action which the stimulus produces in the adjacent tissues; and though one of these reflex contractions, as of a cephalopod's sucker, is effected in a different and much more complicated manner, yet the action, generally considered, does not so far differ as to seem properly transferable to a higher category. Mostly, it would be considered as a misuse of words to call it in any sense psychical. And though as belonging to the order of vital changes which, in their higher complications, we dignify as psychical, it may be held necessary to classify it as psychical; yet it must be admitted that in position it is unquestionably transitional.

Again, it is to be remarked that in highly organized creatures, the physical life is itself regulated by reflex action. Those

rhythmical movements of the alimentary canal which follow the introduction of food, are of reflex origin; as no doubt, also, are those secreting processes by which, under the same stimulus, the digestive fluids are prepared and poured out. Moreover, the various viscera, performing each its separate function, must have their relative activities adjusted—the several processes in the maintenance of which the physical life consists, must be harmonized; and it is held that the due balancing of them is effected by reflex action. The presumption is, that the changes in the state of each viscus are impressed upon the nerves proceeding to ganglia in the Sympathetic, whence they are reflected to the other viscera; and thus their respective activities are co-ordinated.

In yet another respect may we see a close alliance between the physical life and this nascent psychical life. As was shown in a foregoing chapter, the psychical life is broadly distinguished from the physical life by the peculiarity, that its changes instead of being simultaneous and successive, are successive only; but as was also shown, this peculiarity makes its appearance gradually, and only becomes marked when the psychical life becomes high. Now the reflex actions in which the nascent psychical life is seen, are nearly as much characterized by simultaneity as are the purely physical actions. A great number of these simplest psychical changes, may be going on quite independently in the same organism at the same moment. Each of the many legs of a centipede, under the influence of its own ganglion, goes on receiving impressions and performing motions quite independent of the rest: continuing to do so after the creature has been cut in two. And on watching the wave of movements which progresses from end to end of the series of legs—seen still more clearly in a julus—it will be observed that at any moment each leg is in a different phase of its rhythmical movement; and that thus there are, at the same time, in the same organism, a great number of like changes, each at a separate stage of evolution.

Once more, the proximity of these reflex actions to the

physical life, is seen in their unconsciousness. In ourselves, there are constantly going on reflex actions of which we have no immediate knowledge: as those by which the focus of each eye is adjusted to distances, and the closure of the iris to the quantity of light. Other reflex actions of which we can take direct cognizance—as that of breathing—can go on without our thinking of them. And others which are commonly accompanied by sensation—as when the foot is withdrawn from something which tickles it—are found to be most energetically performed, when, from some spinal lesion, sensation has been entirely abolished. Clearly, therefore, in those organisms in which reflex movements alone are seen, they are totally unconscious. The rapid alternations of a millipede's leg or a fly's wing, are as purely automatic as are those of a steam-engine piston; and are doubtless co-ordinated after a generally analogous manner. Just as, in a steam engine, the arrival of the piston at a certain point, itself brings about the opening of a valve serving to admit the steam which will drive the piston in the reverse direction; so, in one of these rhythmically-moving organs, the performance of each motion ends in bringing the organ to a position in which the stimulus to an opposite motion acts upon it.

But though, from all points of view, reflex action is seen to be a species of vital change very little removed from the purely physical changes constituting vegetative life; yet, it may be well to remark, that even in it, we may discern a fulfilment of the primordial conditions to consciousness. At the close of the Special Analysis (§ 100) it was shown, that in the lowest conceivable type of consciousness—that produced by the alternation of two states—there are involved the relations constituting the forms of all thought. And such an alternation of two states as is there supposed, is just that which occurs in the ganglion connected with one of these rhythmically-moving organs.

§ 184. From that lowest kind of reflex action, in which a

single impression produces a single contraction, the ascent is by gradual steps to complications in the stimuli and the acts resulting from them. There is no exact line of demarcation between a single contraction and a combination of contractions. Between the excitation of dispersed muscular fibres, and the excitation of fibres aggregated into definite bundles, the transition is clearly insensible. And hence, under the head of reflex action there are classed numerous cases in which a whole group of muscular actions result from one impression. The decapitated frog which leaps when one of its feet is irritated, supplies an extreme illustration. It would, however, be alike needless and out of place to examine the varieties and complications of reflex action; to do which is the task of the physiologist rather than of the psychologist. Here it simply concerns us to note the bearing of the phenomena of reflex action upon the general argument.

We have to observe, in the first place, that these simplest of psychical changes are those corresponding to the external relations which are only one degree more specialized than the relations to which the physical changes correspond. While the processes of the purely vegetative life are in adjustment with those most general relations between nutriment, oxygen, temperature, moisture, light, which pervade the environment at large; these lowest processes of the animal life are in adjustment with the most general relations of the solid bodies contained in the environment: as those between tangibility and solidity, motion and life.

At the same time that there is so near a relation in scope between the physical life and this lowest psychical life, we have to remark, as above, that the two are closely allied in nature; not only as being both unconscious, but as both consisting of changes that are at once simultaneous and successive.

Further, it is to be noticed, that in conformity with the general law of intelligence, we see, in one of these reflex actions, an established connection between two psychical states, answering to an established connection between two external pheno-

mena. Not that the inner tendency is exactly proportioned to the outer persistency. In many cases it is absolute in the organism, though by no means absolute in the environment. And this is just what is to be looked for in these manifestations of nascent intelligence: seeing that the adjustment of the inner tendencies to the outer persistencies, is the law of intelligence in the abstract, and cannot be fulfilled where the intelligence is incipient.

Lastly we have to note the fact, that these indissolubly connected psychical states are found to exist where there are perpetually-repeated experiences of the external relations to which they answer.

CHAPTER V.

INSTINCT.

§ 185. Using the word, not as the vulgar do to designate all other kinds of intelligence than the human, but restricting it to its proper signification, Instinct may be defined as—compound reflex action. Strictly speaking, no line of demarcation can be drawn between it and simple reflex action, out of which it arises by successive complications. Though the two have been distinguished as *sensori-motor* and *excito-motor*, the distinction seems to me to be one that cannot be maintained as in any way definite. Sensation proper implies consciousness; consciousness, as we understand it, can come into existence only when the chief nervous centre becomes the seat of a varied succession of changes of state; and as the sensory ganglia in their lowest forms, are scarcely at all more subject to such succession than are those ganglia producing the unconscious reflex actions, there is no reason to assume that the impressions they receive are known as sensations. Whether certain muscular contractions are produced by the stimulation of an insect's optic nerve, or by the stimulation of a nerve of touch supplying one of its legs, matters not in so far as the psychological meaning of the phenomenon is concerned. In either case, by a purely automatic process, a certain change in the peripheral extremity of a nerve has produced certain motions: the relation is, for aught that appears, as direct in the one case as in the other: and there is no more reason to assume that the visual impression produces consciousness than that the tactual one does. The only scientific distinctions that can here be drawn, are those based upon the degrees of complexity in the stimuli, and in the consequent actions; and these are simply

distinctions of degree, and not of kind. In so far as an instinctive action involves the co-ordination of many impressions; and in so far as the chief ganglion consequently undergoes complicated changes; in so far may there be incipient sensations—a dawning consciousness; and in so far an instinctive action may be *sensori-motor* or *consensual.* But it is clear that the consciousness is a function of the complexity; and arises only as the complexity increases. The complexity, therefore, is the thing with which we are essentially concerned.

That the validity of this definition of Instinct, as distinguished from the primitive kind of reflex action, may be clearly seen, let us, before going further, take an example. "A fly-catcher," says Carpenter, "immediately after its exit from the egg, has been known to peck at and capture an insect—an action which requires a very exact appreciation of distance, as well as a power of precisely regulating the muscular movements in accordance with it." Now this action, which is distinctly proved by the circumstances to be purely automatic, necessarily implies the combination of a number of separate stimuli. The excitation of a certain group of the retinal nerve-fibres must be one; and this excitation must really be in itself a complex one; seeing, that as the same effect is not produced by casting an image of any size upon the retina; and as the different effects that result from the casting of different images on the retina, must result from differences in the number or combination of the nerve-fibres affected; the retinal stimulus must really be a certain combination of stimuli. Another necessary component in the general stimulus, must be that proceeding from the muscles by which the foci of the eyes are adjusted. And yet another component must be that proceeding from the muscles by which the axes of eyes are directed to a special point. Without impressions proceeding from both these sets of muscles, it would be impossible for the head to be guided in the right direction, or for the beak to be closed at the right moment. Thus then, the

action implies the excitation of two groups of retinal nerves, two groups of nerves proceeding from the muscles which adjust the foci, and two groups of nerves proceeding from the muscles which move the eyes—implies that all these nerves are excited simultaneously in special ways and degrees; and that the special co-ordination of muscular contractions by which the fly is caught, is the result of this special co-ordination of stimuli. Of such complex co-ordination directly resulting from a complex stimulus, we have abundant illustration in ourselves. All our ordinary movements, though originating in volition, are performed in a mode exactly like that described. When putting out the hand to grasp an object before us, we are wholly unconscious of the particular muscular adjustments required. We see the object, and we desire to lay hold of it; and in response to the desire the arm is put out in a special way. But were the various nervous stimuli involved in the visual impression, absent, the muscles of the arm could not be guided aright. That is to say, the special muscular co-ordination is due to the special co-ordination of sensations received from the eye and its adjusting apparatus—the volition being concerned merely in setting these processes going. The difference between one of these actions of our own, and that of the newly-hatched fly-catcher, consists in this; that whereas, in ourselves, the combined impressions and motions being almost infinitely varied and severally repeated with comparative infrequency, are not born with us, but are developed in the course of our first years, in the fly-catcher, by whose race a special combination is perpetually repeated by every individual throughout life, such combination is ready-organized.

But, returning from this illustrative comparison, and considering by themselves such cases as this of the young fly-catcher, it is unquestionable that the process is one of compound reflex action. While in simple reflex action a single impression is followed by a single contraction; while in the more developed forms of reflex action a single impression is followed by a combination of contractions; in this,

that we distinguish as instinct, a combination of impressions produces a combination of contractions: and the higher the instinct the more complex are both the directive and executive co-ordinations. Let us now, however, contemplate the facts in connection with the general laws we are tracing out.

§ 186. Instinct is very obviously further removed from the purely physical life, than is simple reflex action. While simple reflex action is common to the internal visceral processes and to the external processes of animal life; instinct, properly so-called, is not. There are no instincts displayed by the kidneys, the lungs, the liver: they are confined to the actions of the nervo-muscular apparatus, which is the especial agent of the psychical life.

Again, the instinctive actions exhibit much less simultaneity —are in a great degree successive only. The co-ordination of many stimuli into one stimulus, itself involves a diminution of the many separate nervous actions going on simultaneously; and a merging of them into some combined, and therefore serial, process. Whether the various co-ordinated nervous changes which take place when the fly-catcher seizes an insect, are regarded as a series passing through its sensorium in rapid succession, or as consolidated into two successive states of its sensorium, it is equally clear that the changes in its sensorium have a much more decided linear arrangement than the changes going on in all the scattered ganglia of a centipede.

Moreover, it is not improbable that, in its higher forms, instinct is accompanied by some approach to what we understand as consciousness. There cannot be a co-ordination of many stimuli, without some centre of communication through which they are all brought into relation. In the process of bringing them into relation, this centre must be subject to the influence of each—must undergo many changes. And the quick succession of changes in a sentient centre, constitutes the raw material of consciousness. The implication is, there-

fore, that in proportion as instinct is developed, some kind of consciousness becomes nascent.

Yet further, the instinctive actions are more removed from the purely physical actions in this, that they answer to external phenomena that are more complex and more special. While the purely physical actions respond to those most general relations common to the environment as a whole; while the simple reflex actions respond to some of the most general relations common to the individual objects it contains; these compound reflex actions which we class as instincts, respond to those more involved relations by which certain orders of objects and actions are distinguished from others.

Thus, in the phenomena of instinct, a greater differentiation of the psychical from the physical life is seen; alike in the growing distinction between the vegetative and animal systems; in the increasing seriality of the changes in the animal system; in the consequent rise of incipient consciousness; and in the higher complexity of the outer relations to which inner relations are adjusted: which last is indeed the essence of the advance, to which the others are necessary accompaniments.

§ 187. But now let us consider how, by accumulated experiences, the compound reflex actions may be developed out of the simple ones.

For our example we may fitly take some low aquatic creature endowed with rudimentary eyes. As was before remarked, eyes of this character, sensitive as they are only to the strongest changes in the quantity of light, can be affected by opaque bodies moving in the surrounding water, only when such bodies approach so close as almost to touch the surface. Only then can the transit of such bodies produce a sufficiently marked change to be appreciated by nascent vision. But almost always the bodies that are carried by their motion quite close to the organism, will, by their further motion, be brought in contact with it. The cases in which the movement of an external body is such as to carry it by, almost at

a tangent to that part of the organism where the rudimentary eye is placed, so as nearly to touch the surface in passing, but not quite, must be exceptional. Evidently, therefore, in its earliest forms, sight is, as before said, little more than anticipatory touch: visual impressions are habitually followed by tactual ones. But tactual impressions are, in all these creatures, habitually followed by contractions—contractions which, as pointed out in another place (§ 134), are in all probability the necessary effects produced by mechanical disturbance upon the vital activities—contractions which, under like stimuli, are seen even in certain plants, and are so shown to be producible by alterations in the processes of the purely physical life. Result as they may, however, it is beyond question that from the zoophytes upwards, touch and contraction form an habitual sequence; and hence, in creatures in whom the incipient vision amounts to little more than anticipatory touch, there constantly occurs the succession—a visual impression, a tactual impression, a contraction. Now the evolution of a nervous system, is a necessary concomitant of that specialization which originates the senses. Until the general sensitiveness is in some degree localized, the internuncial function of the nervous system, cannot exist: and there can be no such localized sensitiveness without there being something in the shape of nerves. A nascent sense of sight, therefore, implies a nascent nervous communication.* And along with a nascent nervous communication we may see the first illustra-

* How nervous communications are established, both primarily and in all after stages of evolution, it would be going too much out of the way here to inquire. It may, and I think not improbably will, turn out, that they are produced by the very actions which they have to co-ordinate. There is evidence pointing to the inference, that the law in virtue of which all psychical states that occur together tend to cohere, and cohere the more the more they are repeated together, until they become indissoluble—the law in virtue of which many of our own acquired actions become reflex by constant repetition—is the law in virtue of which nervous connections are formed. When a change made in one part of an organism is habitually followed by a change in another; and when the electrical disturbance thus produced in one part, comes to be in constant relation to that in another; the frequent restoration of electrical equilibrium between these two parts, being always effected through the same route, may tend to establish a permanent line of conduction—a nerve. On a future occasion I hope to say something in justification of this hypothesis.

tion of the law of developing intelligence. If psychical states (using the term in its widest sense) which constantly follow one another in a certain order, become ever more closely connected in that order, so as eventually to become inseparable; then it must follow that if, in the experience of any race of organisms, a visual impression, a tactual impression, and a contraction, are continually repeated in this succession, the several nervous states produced will become so consolidated that the first cannot be caused without the others necessarily following—the visual impression will be instantly succeeded by a nervous excitation like that which a tactual impression produces; and this by a contraction. Thus there will arise a contraction in anticipation of touch: and when more perfect vision is acquired, there will result those convulsive movements which low organisms display when any large moving object comes into their neighbourhood.

Thus far, however, the phenomena are those of simple reflex action; or rather, reflex action that is incipiently compound. Let us now consider what must result from a further development of vision. Such further development of vision we know from positive evidence takes place under continued exercise. The Bosjesman, ever on the look-out for distant enemies and prey, has eyes very far exceeding those of the European in acuteness; and it is a legitimate inference that, with rudimentary eyes as with developed ones, increased activity will entail increased power. Assuming such increased power, what must be its consequences? The simultaneous consequences must be, that the same bodies will be discerned at a greater distance, and smaller bodies will be discerned when close to. Both of these will produce obscurations that are faint, in comparison with that complete obscuration produced by some large moving body that is about to strike the surface. But from the time when they first become appreciable, such faint obscurations will not, like the extreme ones, be habitually followed by strong tactual impressions and subsequent contractions. If produced by a large object passing at some

distance, there will probably be no collision—no tactual impression at all. If produced by a small object close to, the collision that follows will be comparatively slight—so slight as not to induce a violent contraction, but simply sufficient to produce an incipient tension in the muscular apparatus—a tension such as that seen in any creature about to seize upon prey. This is by no means an assumption. It is an established fact, that among animals in general, ourselves included, a sensation or nervous stimulus, which, if slight, simply rouses attention and produces some slight muscular action, will, if it becomes intense, cause convulsive contractions of the muscles in general. It is therefore a deduction from a well-established law of the nervo-muscular system, that a creature possessed of this somewhat improved vision, will, by a partial obscuration of light, have its muscles brought into a state of partial tension—a state fitting them either for the seizure of a small animal, should the partial obscuration be caused by the impending collision of one, or for sudden retreat into a shell or convulsive movements of escape, should the obscuration be increased by the near approach of a larger animal. Thus, even by this simple advance there must necessarily be produced a somewhat greater speciality and complexity in the inner relations answering to outer relations.

But now let us go a step further. Let us suppose the creature to be one that habitually moves about in the water; and let us suppose a somewhat further development of the faculty of sight—a development consisting in such enlargement of the retina, and such subdivision of it into separate sensitive agents, as shall admit of its different parts being independently affected. In such a creature, the eyes are subject to frequent change of impressions produced by the objects amid which it swims. These impressions fall upon different parts of its retinas, according to the positions of the objects making them. Those on one side of the creature either affect one retina only, or one much more than the other. Those above it have their images cast on the lower parts of

the retinas. Those below it, if visible at all, cast images on their upper parts. Of all the impressions thus made, however, few, if any, are directly followed by any tactual impression: the creature's forward movement carries it away from the objects making them. Only when these lateral impressions made by moving objects are very strong—only when they are the impressions produced by larger animals, will there result any excitation of the motor powers. Faint lateral impressions, not being habitually followed by any tactual impressions, will have no effect upon the actions. But now mark that there are certain visual impressions, which, though not strong, are constantly followed by tactual ones; and by tactual ones of a particular kind: those impressions, namely, which are made by small objects in front. When, during its passage through the water, certain parts of the creature's two retinas are simultaneously affected by impressions of moderate strength; it very generally happens, that immediately afterwards, the feelers and head come in contact with some small body serving for food. A visual impression of a special kind, is habitually followed by a tactual impression on the prehensile organs; and, consequently, by all those muscular actions which the presentation of food to the prehensile organs calls forth. In the nature of things, this sequence must continually occur. The excitation of a particular group of retinal nerves; the excitation of the nerves of the prehensile organs; and the excitation of a special set of muscles; must become an established succession. In the creature's experience, these three psychical states are habitually connected; and must, by repetition in countless generations, become so coherent that the special visual impression will directly call forth the muscular actions by which prey is seized. Eventually, the sight of a small object in front, will, of itself, set a-going the various motions requisite for the capture of prey.

Here then, we have one of the simpler forms of instinct, which, under the requisite conditions, must necessarily be established by accumulated experiences. Let it be granted that in

all creatures, as in ourselves, the law is and ever has been, that the more frequently psychical states occur in a certain order, the stronger becomes their tendency to cohere in that order, until they at last become inseparable; let it be granted that this tendency is, in however slight a degree, inherited, so that if the experiences remain the same, each successive generation bequeathes a somewhat increased tendency; and it follows, that, in cases like the one described, there must inevitably be established an automatic connection of nervous actions, corresponding to the external relations perpetually experienced. If, from some change in the environment of any species, its members are frequently brought in contact with a new relation; if the organization of the species is so far developed as to be impressible by the terms of the new relation, in close succession; then, an inner relation corresponding to this new outer relation, will gradually be formed; and will in the end become organic. The organized relations previously existing in the species will be further complicated by a superinduced relation. As in the case described, where the simultaneous excitation of two groups of nerve-fibres proceeding from special parts of two retinas is the stimulus, a compound reflex action will arise out of simple ones. An outer relation one stage more complex than before, will be responded to by an inner relation one stage more complex than before. And so on in subsequent stages of progress.

Of course this is not meant as anything more than a rough indication of the mode in which the general principles that have been enunciated, explain the development of instincts. The abstract law of intelligence being, that the strengths of the inner cohesions between psychical states must be proportionate to the persistencies of the outer relations to which they answer; and the development of intelligence into conformity with the law, being, in all cases of which we have positive knowledge, secured by the one simple principle that the outer relations produce the inner relations, and make the inner relations strong in proportion as they are themselves persistent; it was requisite to inquire whether there is

reason to think that the intelligence concerning whose genesis we have no positive knowledge, had a like origin. And all that it is above proposed to show, is, that reasoning deductively from the conditions of the case, this same one simple principle appears sufficient to account for the facts—or rather, for a type of them. To trace out the actual development of instincts, in their infinite varieties and complications, must ever remain impossible. The data are inaccessible; and were they accessible, could not be adequately grasped. The foregoing is to be taken merely as an adumbration of the probable mode of development.

§ 188. And now let us consider what must be the ulterior results of this mode of development. Assuming some such process as that above suggested, to be the one by which the instincts in general are evolved; let us inquire what must must be the general characteristics of the evolution regarded in its ensemble; and observe how far they agree with the actual ones.

Without referring back to the argument elaborated in the General Synthesis, it will be clear that the progression from the lower to the higher instincts, is, throughout, a progression towards greater speciality and complexity of correspondence. The simple contraction exhibited by some creature having a rudimentary eye, when an opaque object is suddenly passed before that eye, is a much more general and more simple response than that witnessed in the creature which grasps the prey passing before it. In the first case, the effect is produced whatever the relative position of the object, providing the obscuration be considerable: in the second, it is produced only when the object is just in front. To the outer relation between a moving opacity and a living solid body, is now added a relation of position: and not only a relation of position, but one of magnitude; seeing that the effect is not the same when a large as when a small object is presented. That is to say, the external phenomenon responded to, is a co-ordinated group

of relations; and internally, there is a co-ordinated group of changes—not a single impression and a single motion, but at least a pair of impressions and a considerable complication of motions. The correspondence is alike more complex and more special.

Now, that the evolution of intelligence by the multiplication of experiences, must necessarily follow this order, is demonstrable *à priori*. Were there no other proof, there would be the all-sufficient one, that as, in the environment, the phenomena that are the most complex and the most special are the least frequent, the experiences of them can never be so numerous as are the experiences of the simple and more general phenomena. In the daily life of every organism, the relation between a passing obscuration and a living body, is more general than the relation between one degree of obscuration and danger, or between another degree of obscuration and food; and each of these relations is more general than the relation between a particular size and form of visual impression and a particular class of objects; and this relation is more general than that between a particular size, form, and colour of visual impression, and a certain species of that class; and this again is more general than the joint impressions of form, size, colour, and motions, made by a member of such species when adopting a peculiar mode of defence. And as, in ascending from those simple relations exhibited by all bodies in common, the more complex the relations become, the more infrequent is their occurrence; it is an inevitable corollary, that if inner relations are moulded to outer relations by the accumulation of experiences, the simpler must be established before the more complex.

Still more clearly will the necessity of this order of progression be perceived, when it is remembered that, both externally and internally, the complex relations are composed of the simple ones; and must, therefore, come after them. Before there can be the relations presented by matter in motion, there must be those general relations of resistance and extension

exhibited by the matter that moves. Before there can exist the relations implied in the action of one body on another, there must first exist the relations implied in the existence of each body. Before there can arise all those involved relations displayed in the movements of a living creature, there must first exist those chemical relations among its elements, and those structural relations among its organs, by which these involved relations are made possible. And manifestly, if the organization of inner relations in correspondence with outer relations, results from a continual registration of experiences, it is similarly impossible that the complex relations should be established before there have been established the simpler relations they involve.

Duly observing that this corollary from the experience-hypothesis is in conformity with the facts, so far as they are accessible to us, let us go on to observe some important inferences that are deducible from it.

§ 189. If, looking at the progress in its general aspect, we see that simple and general relations in the environment must be those most frequently experienced, those first responded to, and those to which the response becomes most decided; if external relations a grade less simple and general are thus rendered appreciable, and by a repeated, though a less frequently repeated, experience, also establish answering internal relations; and if this process goes on slowly extending to relations successively more complex and special, and less frequent; then it must happen, that there will ultimately be established in the organism, a great number and variety of psychical relations having different degrees of coherency. While an infinity of experiences will have rendered the first and simplest of these psychical relations absolutely indissoluble; while experiences, which, if not actually so great in number as the first, have yet been practically infinite in number, may have given indissolubleness to psychical relations that are a degree more complex; while relations, even of several succeeding degrees of complexity,

though successively less frequent in experience, may yet have been so frequent as to have become psychically organic; yet it is manifest, that with relations increasingly complex and decreasingly frequent, there must come a point at which the answering psychical relations will no longer be absolutely coherent. That this may be thoroughly understood, let us illustrate it by symbols.

Suppose A and B to represent two attributes of matter in general—say extension and resistance—to the constant relation between which, a responsive relation has been established in the organism. Suppose C and D to be two extremely general attributes of animal matter—say motion and life—to which also there is a responsive internal relation. It is quite comprehensible that experiences of the united group of attributes A, B, C, D, recurring as they do in every creature met with, may eventually establish an answering connection of internal relations that is practically as absolute as the original ones. It is also comprehensible that if the creatures commonly serving for prey are of one size, L, while those found to be enemies are in most cases of another size, M; continued experience may establish different organic responses to the different groups of coexistent attributes, A, B, C, D, L, and A, B, C, D, M. And it is comprehensible, too, that when each of these large classes comes to be distinguishable into sub-classes—say by means of differences of colour—the experiences of the two groups A, B, C, D, L, S, and A, B, C, D, L, T, and of the two groups A, B, C, D, M, P, and A, B, C, D, M, Q, may still be so numerous, that the answering psychical changes are indissolubly united. But clearly, as, in course of further progress, the groups of attributes and relations that are distinguished from each other and separately responded to, become more numerous; as, by successive additions of further distinctive attributes and relations, such groups become more complex; and as each more specific kind of group is, by consequence, less frequently repeated in experience; it follows, of necessity, that the answering psychical changes must become less coherent. Not

only must the group of internal states by which the group of external phenomena are symbolized, be less definitely aggregated—or at any rate the more recently added constituents of it—but the entire group, considered as a composite impression, must have a smaller power of producing the special set of actions by which the appropriate adjustment is made. This is an inevitable corollary.

And now observe the implication. If, as the instincts become higher and higher, the various psychical changes of which they are severally composed become less and less definitely co-ordinated; there must come a time when the co-ordination of them will no longer be perfectly regular. If these compound reflex actions, as they grow more compound, also become less decided; it follows that they will eventually become comparatively undecided. The actions will begin to lose their distinctly automatic character. And that which we call instinct will gradually merge into something higher.

Thus, then, we see that the conclusions deducible from the experience-hypothesis, are in harmony with such facts as we possess. We see that the evolution of instincts, as resulting from experience, is quite comprehensible. We see that, if produced by experience, this evolution must proceed from the simple to the complex; which is the indication of positive evidence so far as it is attainable. And we see that by a progression thus wrought out, instinct must in the end insensibly pass into a higher order of psychical action; which is just what we find it to do in the higher animals.

CHAPTER VI.

MEMORY.

§ 190. That growing complication of the correspondence, which, as we have just seen, necessitates a merging of the automatic actions into the non-automatic actions, at the same time introduces divisions of the process of correspondence into separate phases. While, in its simple form, the adjustment of certain inner to certain outer relations, is one complete and indivisible action; in its complex form, such adjustment is composed of several stages capable of a more or less complete dissociation from each other—capable of independent occurrence; and so, capable of forming fragments of correspondences. Thus, among others, results the order of psychical actions known as Memory. While, in any instinctive act, we see an entire process of bringing internal relations into harmony with external relations; Memory, taken alone, exhibits relations in consciousness which not only do not include any active adjustment of the organism to its environment, but which often have but a comparatively indefinite reference to external relations. Though, without doubt, those successions of ideas which constitute memory, are all representative of some past experiences of the external world; though even our recollections of purely internal events—peculiar emotions we have had, and thoughts that have struck us—may be affiliated upon those impressions from without, which form the raw material of consciousness; yet, as a great part of our remembrances stand for external combinations of phenomena that were purely fortuitous, it is clear that, even considered as fragments of correspondences, they cannot be held to have as marked a harmony with the environment

as the parallel parts of automatic actions have. Though each act of recollection is the establishment of an inner relation answering to *some* outer relation; yet, as that outer relation is very frequently one that existed only for an instant, and will never occur again, the inner relation that is established in the act of recollection, is often one answering to no relation now existing, or that ever will exist; and in that sense is not a correspondence. The correspondence here becomes evanescent.

From this it will probably be inferred, that a satisfactory account of Memory, as viewed from our present stand-point, is by no means easy. Its varied and irregular phenomena seem at first sight to acknowledge no law. The doctrine that all psychical changes are interpretable as incidents of the correspondence between the organism and its environment, appears to be at fault. Besides the fact that part of the psychical changes constituting Memory, have reference to no existing outer relation; there is the further fact, that very many of our associations of ideas have apparently little or nothing to do with effecting an adjustment between inner to outer relations. And more especially difficult will it be thought to trace any connection between Memory and Instinct. But though the position of Memory, in the psychological system here sketched out, may not be at once understood—though many will be inclined, even after some consideration, to regard it as a faculty altogether unrelated to the lower psychical faculties, and one of which the genesis is inexplicable; yet, it needs but to follow out the synthesis thus far carried, to see clearly that Memory must result from that same process of development by which Instinct, becoming more and more complicated, finally merges into the higher forms of psychical action. And I do not know a clearer proof of the general doctrines enunciated, than that they furnish an answer to this seemingly insoluble problem.

Some clue to the right comprehension of the matter, will be gained on considering, that while, on the one hand, Instinct

may be regarded as a kind of organized memory; on the other hand, Memory may be regarded as a kind of incipient instinct. The inseparable psychical states exhibited in the automatic actions of a bee building one of its wax cells, answer to outer relations so constantly experienced that they are, as it were, organically remembered. And that cohesion of psychical states implied in any ordinary recollection, is a cohesion which becomes stronger by a repeated succession of such psychical states; and so is capable of approximating more and more to the indissoluble, the automatic, or instinctive cohesions. But, leaving rough suggestions, let us again take up the general argument from the point reached at the close of the last chapter.

§ 191. So long as the psychical changes are completely automatic, there cannot exist any Memory, as we understand it: there cannot exist anything like those irregular psychical changes seen in the association of ideas. The hypothesis itself, implying that the internal relations are organic and antecedent to the experience of the individual, necessarily excludes those internal relations determined by individual experience, which Memory presupposes. But when, as a consequence of advancing complexity and decreasing frequency in the groups of external relations responded to, the answering groups of internal relations become less perfectly organized —when they become so involved as to fail in their automatic regularity; then, what we call Memory becomes nascent. For the elucidation of this, we must again have recourse to symbols.

As before, let A, B, C, D, represent the group of coexistent attributes common to living bodies in general; let e, f, g, stand for the further attributes distinctive of some class of creatures mostly serving for prey; and let *h*, *k*, be the peculiar attributes of some species of that class, which, when attacked, defends itself in a particular way; while *h*, *m*, are the somewhat similar attributes of another species whose defence

amounts to a retaliation worse than the attack. We have, then, two somewhat similar complex groups of coexistent attributes, A, B, C, D, e, f, g, *h*, *k*, and A, B, C, D, e, f, g, *h*, *m*, which, by the hypothesis, are not very frequently repeated in experience; but which, when they do occur, are attended by different consequences. Of these somewhat similar complex groups, the attributes A, B, C, D, being common to all living creatures, and presented in every experience of them, are responded to by automatically connected internal states; e, f, g, the attributes of creatures serving for prey, being extremely general, have also answering internal states that are automatically connected with the first, and with those motor changes which the presentation of prey calls for; while *h*, *k*, and *h*, *m*, from their comparatively infrequent recurrence, are represented by internal states that are not organically co-ordinated with their respective groups, or with the motor changes which those groups should produce. Such being the conditions of the case, let us consider what must be the consequences.

In the first place, the mere complication in the groups of impressions serving as stimuli to special actions, may itself be held to imply something like a nascent memory. For as, on the one hand, the nervous centre by which any set of impressions A, B, C, D, e, f, g, *h*, *k*, are co-ordinated, cannot receive all these impressions at the same instant; and as, on the other hand, the special actions to be produced, can be produced only by the joint stimulus of all these impressions; it follows that the nervous effects they severally imply, must have a certain small persistency, so that the last may arise before the first fades away.

Not to dwell upon this, however, let us pass on to remark, that in proportion as the states answering to the attributes *h*, *k*, and those answering to the *h*, *m*, have been unfrequently connected with their respective group of states, and the actions succeeding them; in the same proportion must the nervous changes by which they are themselves produced, and by which

they produce subsequent changes, be slow. It is a universal fact respecting the connection of psychical states, that not only does frequent recurrence make them increasingly strong, but it makes the transitions more and more rapid; and conversely, it is a fact of which we have abundant experience, that incipient psychical connections take an appreciable time—a fact well exemplified in the learning of a new language. But the tolerably deliberate succession of psychical states is one of the conditions to Memory. A remembrance is necessarily a state of consciousness which lasts an appreciable time. The nervous states which are gone through instantaneously—as those by which we infer the distances of the objects we look at—do not enter into what we term Memory at all; we are in fact unconscious of them, because they are not states of our consciousness that have any appreciable persistence. Hence, then, the occurrence of these comparatively slow psychical changes, is a step towards the evolution of Memory.

But now observe a further consequence. When either of the groups of attributes A, B, C, D, e, f, g, *h*, *k*, or A, B, C, D, e, f, g, *h*, *m*, is presented; the set of impressions A, B, C, D, e, f, g, produced in common by both of them, and by all creatures serving for prey, tends to excite the actions by which prey is ordinarily caught. At the same time, the impressions produced by *h*, *k*, or *h*, *m*, as the case may be, tend in some degree to excite those modified actions which occurred in experience after such impressions. Not only however, by the hypothesis, is the actual excitation of such modified actions uncertain, from the experiences having been insufficiently repeated; but the two tendencies are more or less conflicting. The impression resulting from the attribute *h*, being common to both groups, tends equally to excite either of the modified sets of actions: in the one case a particular mode of attack; in the other case, running away. And at the same time, the tendencies towards both these modified sets of actions are antagonized by the tendency towards the original mode of action. Hence, from the balance of these various

tendencies, it will often happen that no immediate action at all will ensue. The various psychical states involved in each set of motions, will severally become nascent; but will none of them reach that intensity which they would have were the motions performed. In the chief nervous centre there will arise a conflict among the impressions, and by consequence among the motor impulses which those impressions tend to produce; and these motor impulses, being severally supplanted by one another before they pass into actual motor changes, will each of them consist of an incipient or weak form of that nervous state which would have resulted had the motor change actually occurred. But such a succession of states constitutes *remembrance* of the various motor changes which thus become incipient—constitutes a *memory*. To remember the colour red, is to have, in a weak degree, that psychical state which the presentation of the colour red produces: to remember a motion just made with the arm, is to feel a repetition, in a faint form, of those internal states which accompanied the motion—is an incipient excitement of all those nerves whose stronger excitement was experienced during the motion. Thus then, the nascent nervous excitements that arise during this conflict of tendencies, are really so many *ideas* of the motor changes which, if stronger, they would cause—a *recollection* of such changes. And thus, Memory necessarily comes into existence whenever automatic action is imperfect.

This, however, is not all. It remains to be pointed out that by this process of development, there results in the organism not only a memory of its own movements and modes of action; but also of those complicated combinations of impressions which it receives through the senses. It is not simply that as the external groups of attributes and relations responded to become more and more complex, and by implication more and more infrequent, the answering psychical changes become more loosely connected with each other, and with the motor changes appropriate to them; and that so, the groups of impressions being less automatically coherent, a nascent memory

of the component impressions becomes possible; but it is that the same progress which has given the ability to receive the complex impressions required to determine complex actions, has given the further ability to receive complex impressions which do not tend to determine any actions at all. That same evolution of the senses and the nervous system, which has given a capability of distinguishing many different kinds of enemies and prey, by the special combinations of attributes they severally present, has, by implication, given a capability of distinguishing among other things than enemies and prey. The power of co-ordinating the impressions of size, form, colours, motions, which stand for a particular animal, is likewise a power of co-ordinating the various impressions that stand for trees, plants, stones, and all surrounding things. The great majority of these surrounding things, however, have no immediate relation to the actions of the organism—are not habitually followed by any special motor changes; and therefore do not tend to excite motor changes. But while these multiplied and varied impressions produced by lifeless and motionless objects, have no direct connections with the actions, and do not tend automatically to arouse them; they have direct connections with each other, of all degrees of constancy; and, by consequence, have all degrees of the tendency to produce each other. While the absolutely persistent relations among external attributes, are responded to by inseparable relations of psychical states; the others, in all their various grades of persistency, are responded to by psychical states of all degrees of cohesion. It results, therefore, that of the impressions produced by adjacent objects during the movements of the organism, each tends to make nascent certain other impressions with which it has been connected in experience—calls up ideas of such other impressions; that is —causes a remembrance of the attributes previously found in connection with the perceived attributes. As these psychical states have in their turn been connected with others, they tend to arouse such others; and thus there arises that succes-

sion of ideas, partly regular, partly irregular, which we call Memory—regular in so far as the connections of external phenomena are regular; and irregular in so far as the groups of those phenomena occur irregularly in the environment.

§ 192. This truth, that Memory comes into existence when the connections among the psychical states cease to be perfectly automatic, is in complete harmony with the obverse truth, illustrated in all our experience, that as fast as the connections of psychical states which we form in Memory, become, by constant repetition, automatic, they cease to be part of Memory. We do not speak of ourselves as remembering those relations which have become organically, or almost organically registered; we remember those relations only of which the registration is not yet absolute. No one remembers that the object at which he is looking has an opposite side; or that a certain modification of the visual impression implies a certain distance; or that a certain motion of the legs will move him forward; or that the thing which he sees moving about is a live animal. It would be thought a misuse of language were any one to ask another whether he remembered that the sun shines, that fire burns, that iron is hard, and that ice is cold. Even the almost fortuitous relations are not spoken of as remembered, when they have become thoroughly familiar. Though, on hearing the voice of some unseen person slightly known to us, we speak of ourselves as recollecting to whom the voice belongs; we do not use the same expression respecting the voices of those living in the same house with us. And similarly, though, when a child, the reader's knowledge of the meanings of these successive words, was at first a memory of the meanings he had heard given to them; yet now, their several meanings are present to him without any such mental process as that which we call remembrance. Perhaps the most marked instance of the gradual lapse of memory into automatic coherence, is that seen in the musician. Originally, he was taught that each mark on the paper was called by a certain name, and implied that a

particular note on the piano was to be struck; and during his first lessons, each recurrence of this mark was accompanied with a distinct process of recollecting which key on the piano he must strike. By long-continued practice, however, the series of psychical changes that occur between seeing the mark and striking the appropriate key, have coalesced into one almost automatic change. The visual impression produced by the crotchet or quaver; the consciousness of its position on the lines of the stave, and of its relation to the beginning of the bar; the consciousness of the place of the answering key on the piano; the consciousness of the muscular adjustments required to bring the arm, hand, and finger into the attitude requisite for touching that key; the consciousness of the muscular impulse required to give a blow of the due strength, and of the time during which the muscles must be kept contracted to produce the right length of note—all these states of consciousness which at first arose in a distinct succession, and thus formed so many recollections, ultimately constitute a succession so rapid that the whole of them pass through consciousness in an inappreciable time. As fast as they cease to be distinct states of consciousness—as fast as they, by consequence, cease to be represented in memory; so fast do they become automatic: the two things are two sides of the same thing. And thus it happens that the practised musician can continue to play while conversing with those around—while his memory is occupied with quite other ideas than the meanings of the signs before him.

Now the fact that the psychical states which in ourselves are originally connected by the process we call recollection, become, by continued repetition, connected automatically or instinctively, is manifestly the obverse of the fact, that as, by the complication of the instincts, the groups of connected psychical states grow more involved and are less frequently repeated, they must cease to be perfectly automatic, and memory must commence. Our inductive knowledge of the one fact, confirms our deduction of the other.

§ 193. Memory then, pertains to all that class of psychical states which are in process of being organized. It continues so long as the organizing of them continues; and disappears when the organization of them is complete. In the advance of the correspondence, each more complex class of phenomena which the organism acquires the power of recognizing, is responded to at first irregularly and uncertainly; and there is then a weak remembrance of the relations. By multiplication of experiences, this remembrance becomes stronger, and the response more certain. By further multiplication of experiences, the internal relations are at last automatically organized in correspondence with the external ones; and so, conscious memory passes into unconscious or organic memory. At the same time, a new and still more complex order of experiences is thus rendered appreciable; the relations they present occupy the memory in place of the simpler one; they become gradually organized; and, like the previous ones, are succeeded by others more complex still.

Thus, having in the last chapter seen that Instinct is interpretable on the experience-hypothesis, we now see that the experience-hypothesis explains the nature and genesis of Memory.

CHAPTER VII.

REASON.

§ 194. That the commonly assumed line of demarcation between Reason and Instinct has no existence, is clearly implied not only in the argument of the last few chapters, but also in those more general arguments elaborated in preceding parts of this work. Proving, as the Special Analysis did, that there exists a unity of composition throughout all mental processes, from the most abstract reasoning down to the lowest conceivable type of psychical action—proving, as it did, that the lowest forms of animal life are made possible only by a classification of impressions fundamentally the same as that which constitutes the most elaborate thinking of the civilized man; it involved the conclusion, that our ordinary psychological divisions are simply conventional. The General Synthesis again, by showing that all intelligent action whatever is the establishment of a correspondence between internal changes and external coexistences and sequences; and by showing that this continuous adjustment of inner to outer relations progresses in Space, in Time, in Speciality, in Generality, and in Complexity, through insensible gradations; similarly implied that the highest forms of psychical activity arise little by little out of the lowest, and, scientifically considered, cannot be definitely separated from them. So that not only does the recently enunciated doctrine, that the growth of intelligence is throughout determined by the repetition of experiences, involve the continuity of Reason with Instinct; but this continuity is involved in the previously enunciated doctrines.

Indeed, to all who are not blinded by prejudice, the impossibility of establishing any real division between the two may

be clearly demonstrated. If every instinctive action is an adjustment of inner relations to outer relations,—which it is impossible to deny; if every rational action is also an adjustment of inner relations to outer relations,—which it is equally impossible to deny; then, any alleged distinction can have no other basis than some difference in the characters of the relations to which the adjustment is made. It must be that while, in Instinct, the correspondence is between inner and outer relations that are very simple or general; in Reason, the correspondence is between inner and outer relations that are complex, or special, or abstract, or infrequent. But the complexity, speciality, abstractness, and infrequency of relations, are entirely matters of degree: of each there are countless gradations by which its extremes are united. From the coexistence of two attributes, which is responded to by some simple reflex action; up through the groups of three, four, five, six, seven coexistent attributes, responded to by successive grades of instinctive action; we may step by step ascend to such involved groups of coexistent attributes and relations as are exhibited in a living body under a particular state of feeling, or a particular physical disorder. Between relations experienced every moment and relations experienced but once in a life, there are relations that occur with all degrees of frequency. How then can any particular phase of complexity or infrequency be fixed upon as that at which Instinct ends and Reason begins? Will any one be so absurd as to say, that so long as the external phenomenon responded to does not involve more than twenty elements, the response is instinctive; but that if it involves twenty-one the response is rational? Will any one be so absurd as to say, that the response is instinctive where the external phenomenon occurs a dozen times within a given period; but that the response is rational when it occurs but eleven times? Yet such are the absurdities which must be defended by those who contend that Instinct and Reason are fundamentally different.

Thus then we see, that from whatever point of view

regarded, the facts imply an insensible transition from the lower forms of psychical action to the higher. That progressive complication of the instincts, which, as we have found, involves a progressive diminution of their purely automatic character, likewise involves a simultaneous commencement of Memory and Reason. But this joint evolution must be more specifically described.

§ 195. When the perfectly automatic adjustments of inner to outer relations pass into the imperfectly automatic—when the progressing correspondence has advanced beyond the simpler and more frequent phenomena, to those which present groups of relations of considerable complexity, and which occur with comparative rareness—when, by consequence, the repetition of experiences has been insufficient to establish an absolute internal cohesion between the sensory changes produced by such groups and the motor changes required to adapt the organism to them—when such motor changes, and the impressions that must accompany them, simply become nascent—then, by the partial excitation of the nervous agents concerned, there is produced an *idea* of such motor changes and impressions; or, as before explained, a *memory* of the motor changes before performed under like circumstances and of the impressions that resulted. Did the process end here, there would be no manifestation of rationality. But the process does not end here. For though, as shown in the last chapter, these nascent excitations first occur in cases where, from a confusion of the impression with some allied one, there results a confusion among the motor impulses—a conflict among them, and a supplanting of each by another before it has passed beyond its incipient stage; and though, as a consequence, there arises a certain hesitation, which continues as long as these nascent motor excitations, these ideas of certain actions, go on superseding each other; yet, ultimately, it will in nearly all cases happen, that some one impulse will prevail over the rest. As the various antagonist motor tendencies excited, will scarcely

ever be exactly balanced, the strongest of them will at length pass into action; and as this strongest of them must, in the average of cases, be the one that has been the most uniformly and frequently repeated in experience, the action must, in the average of cases, be the one best adapted to the circumstances. But an action thus produced, is nothing else than a rational action. Each of the actions which we call rational, presents three phases exactly answering to those here described:—first, a certain combination of impressions, signifying some combination of phenomena to which the organism is to be adjusted; second, the idea of certain actions before performed under like circumstances, which idea is simply a nascent excitation of the nervous agents before concerned in such actions, either as producers of them or as affected by the production of them; and, third, the actions themselves, which are simply the results of the nascent excitation rising into an actual excitation. That this may be clearly understood, let us take an illustration. Suppose I have had repeated experiences of the fact, that a snarling dog will commonly turn tail when a stone is thrown at him; or even when he sees that stooping motion required for picking up a stone. Suppose that I am again attacked by such a dog: what are the resulting psychical processes? The combination of impressions produced on my senses, and the composite state of consciousness to which they give rise, have been several times followed by that series of motor changes required for picking up and throwing a stone, and by those visual changes produced by these actions and by the dog's retreat. But as these psychical states have repeatedly followed one another in experience, they have acquired a certain degree of cohesion—there is a certain tendency for the psychical states produced in me by the snarling dog, to be followed by those other psychical states that have before followed them: that is, there is a nascent excitation of the motor apparatus concerned in the acts of picking up and throwing; there is a nascent excitation of all those sensory nerves which are affected during such acts; and through these, there is such a nascent excita-

tion of the visual nerves as results on seeing a dog run away. In other words, I have the *ideas* of picking up and throwing a stone, and of seeing a dog run away; for these that we call ideas, are nothing else than weak repetitions of the psychical states caused in us by actual impressions and motions—partial excitements of the same nervous agents. But what happens further? If there is no antagonist impulse—if no other ideas or partial excitations arise; and if the dog's aggressive demonstrations produce on me impressions of adequate vividness; then, these partial excitations pass into complete excitations, and I go through all the previously imagined actions. The nascent motor changes become real motor changes; and the series of processes required for the adjustment of inner to outer relations is completed. This, however, is just the process which, as we see, must necessarily arise whenever, from increasing complexity and decreasing frequency, the automatic adjustment of inner to outer relations becomes at all uncertain or hesitating; and thus it becomes clear, that the actions we call instinctive merge insensibly into the actions we call rational.

If further proof be needed, it is furnished by the converse fact, to which all can testify, that the actions we call rational, are, by long-continued repetition, rendered automatic or instinctive. By implication, this was more or less fully shown in the last chapter, when exemplifying the lapsing of memory into instinct: the two facts are but different aspects of the same fact. But some instances specially exhibiting this second aspect may here be fitly given. Take as one, the actions gone through in such a process as that of shaving, or that of tying a neckerchief. Every man will remember that when, as a youth, he first attempted to guide his fingers in the proper directions by watching the reflections of them in the looking-glass, he was greatly perplexed to move them rightly. The ordinary relations between the visual impressions received from his moving fingers, and the muscular feelings arising from their motions, no longer holding good when he had to deal

with the images of his fingers as seen in the glass, he was led to make movements quite different from those he intended; and it was only after setting himself deliberately to watch how the motions and the reflected appearances were related, and then consciously making a certain motion in expectation of a certain appearance, that he slowly mastered the difficulty. By daily practice, however, the impressions and motions have become so well co-ordinated, that he now goes through them while busily thinking of something else; they have more or less completely lapsed from the rational into the automatic. Still more marked is the analogous process that occurs in the practised microscopist. Everything which he places under the object glass, is seen reversed. All adjustments of the stage, and all motions of his dissecting instruments, have to be made in directions exactly opposite to those which the uninitiated eye would dictate. Yet by practice, this reversed manipulation becomes as easy as ordinary manipulation—it becomes as unnecessary for him to take thought how he shall move his hands, in the one case as in the other. The automatic character of habitual actions is clearly proved when they are performed, as they often are, inappropriately. Any one accustomed daily to traverse particular streets on his way to some place of business, will find that, when intending to branch-off elsewhere, he is apt, if engaged in thought, to follow the usual route—often for a long way beyond the point at which he should have diverged: the impressions produced on him by the familiar objects he passes, severally cause him to make the ordinary crossings and turnings. In the case of reading aloud, again, the law is clearly displayed. Originally, the sight of the letters was followed by a thought of the sounds; and the thought of the sounds, by the vocal actions required to make the sounds. But eventually, the connection between the visual impressions and the vocal actions becomes so far automatic, that, as all have observed, it is possible to read aloud sentence after sentence while so fully occupied in thinking of something else, as to be quite unconscious of the words uttered, and the

ideas conveyed by them. In fact, it will be found on considering them, that the greater part of our common daily actions—actions every step of which was originally preceded by a consciousness of consequences, and was therefore rational—have, by habit, merged more or less completely into automatic actions. The requisite impressions being made on us, the appropriate movements follow; without memory, reason, or volition, coming into play: the adjustment of inner to outer relations has become instinctive.

Not only, however, is it, that instinctive and rational actions pass insensibly into each other; not only is it that rational action arises out of instinctive action whenever this is imperfectly automatic; but it is, that at the same time there arises that order of reasoning which does not directly lead to action—that reasoning by which the great mass of surrounding coexistences and sequences become known. In proportion as the groups of external attributes and relations responded to, become complex—in proportion, that is, as the several elements of each impression become too numerous to be all consolidated into one psychical state; in the same proportion does there arise both the opportunity and the power of foreseeing or inferring such of the attributes or relations belonging to any group, as are not immediately presented. Pure instinct continues so long as the stimuli responded to are made up of components that are few and constant. While the combined impressions of colour, position, size, and motion, which together stand for an adjacent object that can be seized for prey, are alone receivable, the actions will be purely automatic—these impressions simultaneously received will set agoing the appropriate motions. But as fast as, by the organization of experiences, there arises a power of appreciating impressions of a more composite character—as fast as the complicated relations of form, of mixed colouring, of peculiar motions, and so forth, become cognizable in conjunction with those of the more general ones of colour, position, size, and motion; then, it is clear that the attributes and relations united into a group, not only become

too numerous to be all *mentally* presented at the same instant, but too numerous to be all *physically* presented at the same instant. For, the same experiences which have slowly rendered these complex groups of attributes cognizable, have also presented them in such various ways, that sometimes one part of a group has been presented to the senses and sometimes another part of it: sometimes these elements of an animal's form and markings have been visible, and sometimes those: each of the experiences, though on the average like previous ones, has presented some attributes which they did not present, and has lacked others which they did present. Hence it results, that by an accumulation of such experiences, each involved aggregation of external phenomena establishes in the organism an answering aggregation of psychical states, which has the peculiarity that it contains more states than were ever produced, or ever can be produced, by any one of these composite impressions. What must happen from this? It must necessarily happen that when, on any future presentation of the external aggregation of phenomena, certain of these aggregated psychical states are directly produced by the impressions made upon the senses, various others of the psychical states that have been aggregated with them—made coherent to them by experience — become nascent: the ideas of one or more unperceived attributes are aroused: the unperceived attributes are *inferred.* Thus, the same insensible evolution through which instinctive actions pass into rational actions, simultaneously evolves perceptions and rational intuitions out of those complex impressions by which the higher instincts are guided.

Here also, the truth of the doctrine enunciated is confirmed by the established truth of its obverse. As, before, we saw that while, on the one hand, the instinctive actions pass into the rational ones when from increasing complexity and infrequency they become imperfectly automatic, on the other hand the rational actions pass, by constant repetition, into the automatic or instinctive; so here, we may see that while, on the one

hand, rational intuitions similarly arise when the groups of attributes and relations cognized become such that the impressions of them cannot be simultaneously co-ordinated, on the other hand, rational intuitions pass, by constant repetition, into instinctive or automatic intuitions. All the psychological phenomena classed under the title of acquired perceptions, exemplify this truth. All the numberless cases in which we seem directly to know the distances, forms, solidities, textures, &c., of the things around us, are cases in which psychical states originally answering to attributes separately perceived, and afterwards connected in thought by rational intuitions, have, by a perpetual repetition, become indissolubly united; and so constitute intuitions that are automatic or instinctive.

Thus, the common notion that there is a line of demarcation between reason and instinct, has no foundation whatever in fact. The transition is insensible; and the phenomena of the transition are explicable upon the experience-hypothesis. The genesis of instinct in its simpler forms; the development of memory and reason out of it; and the consolidation of rational actions and intuitions into instinctive ones; are alike to be accounted for on the single principle, that the cohesion between psychical states is proportionate to the frequency with which the relation between the answering external phenomena has been presented in experience.

§ 196. But will the experience-hypothesis also suffice to explain the evolution of the higher forms of rationality out of the lower? It will. From the reasoning from particulars to particulars—familiarly exhibited by children, by domestic animals, and by the superior mammalia at large—the progress to inductive and deductive reasoning is similarly unbroken, and similarly determined by the accumulation of experiences. And by the accumulation of experiences is also determined the entire advance of human knowledge, from the narrowest generalizations to generalizations successively wider and wider.

Were it not for the prevalent anxiety to establish some posi-

tive distinction between animal intelligence and human intelligence, it would scarcely be needful to assign any proof of this. As it is, the truth is so manifest that under most of its aspects no one questions it. Every one will admit, that the infant, while yet occupied in drawing those simplest inferences which by and by become consolidated into acquired perceptions, is exercising no higher degree of rationality than the dog that recognizes his own name, the different members of the household, the hours of meals, and the days of the week. Every one must also admit that the steps by which, in the course of its development, the infant advances from these simplest inferences to those inferences of high complexity which are drawn in adult life, are so gradual that it is impossible to mark out the successive steps: no one can name that day in any human life when the alleged division between special and general conclusions was crossed. And hence, every one is bound to admit, that as the rationality of an infant is no higher than that of a domestic animal, if so high; and as, from the rationality of the infant to that of the man, the progress is through insensible steps; there is also a series of insensible steps through which brute rationality may pass into human rationality. And further, it must be admitted that as the assimilation of experiences of successively increasing complexity, alone suffices for the unfolding of reason in the individual human being; so must it alone suffice for the evolution of reason in general.

Equally conclusive is the argument from the history of civilization, or from the comparison of different existing human races. That there is an immense difference in complexity and abstractness between the reasonings of aboriginal Britons, Saxons, and Scandinavians, and the reasonings of the Bacons and Newtons who have descended from them, is a trite remark. That the Papuan of New Guinea does not, and cannot, draw inferences approaching in complication to those daily drawn by European men of science, is no less a platitude. Yet no one contends that there is any absolute distinction between our faculties and those of our remote ancestors, or between the

faculties of the civilized man and those of the savage. Fortunately, there are positive records to show that the advance of the rational faculty towards conceptions of great complication and high generality, has taken place by slow steps—by natural growth. Simple numeration existed before arithmetic; arithmetic before algebra; algebra before the infinitesimal calculus; and the more special forms of the infinitesimal calculus before its more general forms. The law of the scales was known before the general law of the lever was known; the law of the lever was known before the laws of composition and resolution of forces were known; and these were known before the general laws of motion were known. From the ancient doctrine that the curve in which the sun, the moon, and each of the planets, moves, is a circle (a perfectly specific figure); to the doctrine taught by Kepler, that each member of the planetary system describes an ellipse (a much less specific figure); and afterwards to the doctrine taught by Newton, that the curve described by every heavenly body is some conic section (a still less specific figure); the advance in generality, in complexity, in abstractness, is manifest. Numerous like illustrations are furnished by Physics, by Chemistry, by Physiology: all of them showing, in common with the foregoing ones, not only that the advance to wider generalizations has been gradual, but that each more general relation has become known through the experience of relations a degree less general. If then, in the course of human progression, we have positive evidence of an advance from rational cognitions of a low order of generality, to those of a high order of generality, brought about solely by the accumulation of experiences; if the advance thus brought about is as great as that from the highest forms of brute rationality to the lower forms of human rationality—which no one who compares the generalizations of a Hottentot with those of La Place can deny; then, it is a legitimate conclusion, that the accumulation of experiences suffices to account for the evolution of all rationality out of its simplest forms. The attempted distinction between special and general reasoning, cannot be

maintained. The generality of inferences is entirely a thing of degree: and unless it be contended that the rational faculty of the cultivated European, is specifically different from that of a savage or a child; it cannot consistently be contended that there is any specific difference between brute reason and human reason.

To render the argument quite conclusive, it needs but to show, by a special synthesis, that the establishment of every generalization, simple or complex, concrete or abstract, is perfectly explicable in conformity with the principle hitherto traced. The general law that the cohesion of psychical states is determined by the frequency with which they have followed one another in experience, affords a satisfactory solution of the highest as of the lowest psychological phenomena; and is indeed the law which can alone furnish anything like a solution of them. When treating of the integration of correspondences, something was done towards showing that the formation of the most extended generalizations does not differ in method from the formation of the simplest cognitions: but here, by pursuing the argument developed in the preceding chapters, this may be more definitely shown.

As a sample generalization, let us take the discovery of the relation subsisting between the development of the nervous system and the degree of intelligence. Originally, no such relation was known to exist. It was known that certain creatures had more sagacity than others; and it was known that some creatures had larger heads than others; and perhaps to a few it was known that the larger heads commonly contained larger masses of soft whitish matter; but no connection was established between these facts. Intelligent creatures were seen to have various other characteristics besides large brains: most of them were four-legged; most of them were covered with fur; most of them had teeth. And creatures having large brains were seen to have other characteristics than that of intelligence: as strength, length of life, viviparousness.

Hence, there was at first no reason why degree of intelligence and extent of nervous development, should be thought of in connection. What then was needed to establish a mental connection between them? Nothing but an accumulation of experiences; or, as we say—a multiplying of observations. That the rationale of this, and its conformity to the general law, may be fully understood, let us have recourse to symbols. Let A stand for the known characteristic, intelligence. And let us put X to represent the unknown characteristic on which it is dependent, a developed nervous system. Now A is found along with many varieties of size, form, colour, structure, habit, &c.; and X coexists with this, that, and the other peculiarity, besides intelligence. That is to say, there is an immense number of different groups of attributes variously associated with A and X; and by which the relation of A to X is disguised: or to continue the symbols—there are groups, B C D X L F Z A, P L F A Q N X Y, E D Z R X B A O Y, and so on, in countless combinations. But now—calling to mind the universal law, that the cohesion of psychical states is proportionate to the number of times they have been connected in experience—let us inquire what must result in the minds of those who are continually impressed with groups of attributes, which, differing as they do in other respects, are alike in presenting the relation A to X. As in each of these cases, the relation A to X is constant; as the relation of A to any other attribute, and of X to any other attribute, is not constant; as, consequently, the relation A to X occurs with greater frequency than the relation of A to anything else, or X to anything else; it necessarily follows from the general law, that by a repetition of experiences, the psychical states answering to A and X will become more coherent to each other than to the rest of the states with which they occur—there will eventually arise a tendency for A to call up X, and for X to call up A. That is, A and X will come to be connected in thought as attributes that constantly coexist: there will arise the general-

ization that the degree of intelligence varies as the development of the nervous system.

Manifestly, the same reasoning holds however complicated the relations, and however greatly obscured. Involved, and abstract, and varied, as may be the class of phenomena to be generalized; if there has already been reached that grade of intelligence required for cognition of the terms of the relation common to this class of phenomena; then, repeated experiences of such phenomena will inevitably establish a generalization of them, in virtue of that same simple law of psychical changes which we have found sufficient to explain the lower phenomena of intelligence.

§ 197. And here seems to be the fittest place for pointing out how the general doctrine that has been developed, supplies a reconciliation between the experience-hypothesis as commonly interpreted, and the antagonist hypothesis of the transcendentalists. Probably the reader will by this time have foreseen the mode of this reconciliation. But to redeem the promise elsewhere made (§ 6), it will be necessary to give a definite exposition of it.

As most who have read thus far will have perceived, both the general argument unfolded in the synthetical divisions of this work, and many of the special arguments by which it has been supported, imply a tacit adhesion to the development hypothesis—the hypothesis that Life in its multitudinous and infinitely-varied embodiments, has arisen out of the lowest and simplest beginnings, by steps as gradual as those which evolve a homogeneous microscopic germ into a complex organism. This tacit adhesion, which the progress of the argument has rendered much more obvious than I anticipated it would become, I do not hesitate to acknowledge. Not, indeed, that I adopt the current edition of the hypothesis. Ever since the recent revival of the controversy of "law *versus* miracle," I have not ceased to regret that so unfortunate a statement of the law should have been given—a statement quite irreconcilable with

very obvious truths, and one that not only suggests insurmountable objections, but makes over to opponents a vast series of facts which, rightly interpreted, would tell with great force against them. What may be a better statement of the law, this is not the place to inquire. It must suffice to enunciate the belief that Life under all its forms has arisen by a progressive, unbroken evolution; and through the immediate instrumentality of what we call natural causes. That this is an hypothesis, I readily admit. That it may never be anything more, seems probable. That even in its most defensible shape there are serious difficulties in its way, I cheerfully acknowledge: though, considering the extreme complexity of the phenomena; the entire destruction of the earlier part of the evidence; the fragmentary and obscure character of that which remains; and the total lack of information respecting the infinitely-varied and involved causes that have been at work; it would be strange were there not such difficulties. Imperfect as it is, however, the evidence in favour, appears to me greatly to preponderate over the evidence against. Save for those who still adhere to the Hebrew myth, or to the doctrine of special creations derived from it, there is no alternative but this hypothesis or no hypothesis. The neutral state of having no hypothesis, can be completely preserved only so long as the conflicting evidences appear exactly balanced: such a state is one of unstable equilibrium, which can hardly be permanent. For myself, finding that there is *no* positive evidence of special creations, and that there is *some* positive evidence of evolution—alike in the history of the human race, in the modifications undergone by all organisms under changed conditions, in the development of every living creature—I adopt the hypothesis until better instructed: and I see the more reason for doing this, in the facts, that it appears to be the unavoidable conclusion pointed to by the foregoing investigations, and that it furnishes a solution of the controversy between the disciples of Locke and those of Kant.

For, joined with this hypothesis, the simple universal law

that the cohesion of psychical states is proportionate to the frequency with which they have followed one another in experience, requires but to be supplemented by the law that habitual psychical successions entail some hereditary tendency to such successions, which, under persistent conditions, will become cumulative in generation after generation, to supply an explanation of all psychological phenomena; and, among others, of the so-called "forms of thought." Just as we saw that the establishment of those compound reflex actions which we call instincts, is comprehensible on the principle that inner relations are, by perpetual repetition, organized into correspondence with outer relations; so, the establishment of those consolidated, those indissoluble, those instinctive mental relations constituting our ideas of Space and Time, is comprehensible on the same principle. If, even to external relations that are frequently experienced in the life of a single organism, answering internal relations are established that become next to automatic —if, in an individual man, a complex combination of psychical changes, as those through which a savage hits a bird with an arrow, become, by constant repetition, so organized as to be performed almost without thought of the various processes of adjustment gone through—and if skill of this kind is so far transmissible, that particular races of men become characterized by particular aptitudes, which are nothing else than incipiently organized psychical connections; then, in virtue of the same law it must follow, that if there are certain relations which are experienced by all organisms whatever—relations which are experienced every instant of their waking lives, relations which are experienced along with every other experience, relations which consist of extremely simple elements, relations which are absolutely constant, absolutely universal—there will be gradually established in the organism, answering relations that are absolutely constant, absolutely universal. Such relations we have in those of Space and Time. Being relations that are experienced in common by all animals, the organization of the answering relations must be cumulative, not in each race of

creatures only, but throughout successive races of creatures; and must, therefore, become more consolidated than all others. Being relations experienced in every action of each creature, they must, for this reason too, be responded to by internal relations that are, above all others, indissoluble. And for the yet further reason that they are uniform, invariable, incapable of being absent, or reversed, or abolished, they must be represented by irreversible, indestructible connections of ideas. As the substratum of all other external relations, they must be responded to by conceptions that are the substratum of all other internal relations. Being the constant and infinitely-repeated elements of all thought, they must become the automatic elements of all thought—the elements of thought which it is impossible to get rid of—the "forms of thought."

Such, as it seems to me, is the only possible reconciliation between the experience-hypothesis and the hypothesis of the transcendentalists: neither of which is tenable by itself. Various insurmountable difficulties presented by the Kantian doctrine, have already been pointed out; and the antagonist doctrine, taken alone, presents difficulties that I conceive to be equally insurmountable. To rest with the unqualified assertion that, antecedent to experience, the mind is a blank, is to ignore the all-essential questions—whence comes the power of organizing experiences? whence arise the different degrees of that power possessed by different races of organisms, and different individuals of the same race? If, at birth, there exists nothing but a passive receptivity of impressions, why should not a horse be as educable as a man? or, should it be said that language makes the difference, then why should not the cat and dog, out of the same household experiences, arrive at equal degrees and kinds of intelligence? Understood in its current form, the experience-hypothesis implies that the presence of a definitely organized nervous system is a circumstance of no moment—a fact not needing to be taken into account! Yet it is the all-important fact—the fact to which, in one sense, the criticisms of Liebnitz and

others pointed—the fact without which an assimilation of experiences is utterly inexplicable. The physiologist very well knows, that throughout the animal kingdom in general, the actions are dependent on the nervous structure. He knows that each reflex movement implies the agency of certain nerves and ganglia; that a development of complicated instincts, is accompanied by a complication of the nervous centres and their commissural connections; that in the same creature in different stages, as larva and imago for example, the instincts change as the nervous structure changes; and that as we advance to creatures of high intelligence, a vast increase in the size and complexity of the nervous system takes place. What is the obvious inference? Is it not that the ability to co-ordinate impressions and to perform the appropriate actions, in all cases implies the pre-existence of certain nerves arranged in a certain way? What is the meaning of the human brain? Is it not that its immensely numerous and involved relations of parts, stand for so many *established* relations among the psychical changes? Every one of the countless connections among the fibres of the cerebral masses, answers to some permanent connection of phenomena in the experiences of the race. Just as the organized arrangement subsisting between the sensory nerves of the nostrils and the motor nerves of the respiratory muscles, not only makes possible a sneeze, but also, in the newly-born infant, implies sneezings to be hereafter performed; so, all the organized arrangements subsisting among the nerves of the cerebrum in the newly-born infant, not only make possible certain combinations of impressions into compound ideas, but also imply that such combinations will hereafter be made—imply that there are answering combinations in the outer world—imply a preparedness to cognize these combinations—imply faculties of comprehending them. It is true that the resulting combinations of psychical changes, do not take place with the same readiness and automatic precision as the simple reflex action instanced—it is true that a certain amount of individual ex-

perience seems required to establish them. But while this is partly due to the fact that these combinations are highly involved, extremely varied in their modes of occurrence, made up therefore of psychical relations less completely coherent, and so need some further repetitions to perfect them; it is in a much greater degree due to the fact, that at birth the organization of the brain is incomplete, and does not cease its spontaneous progress for twenty or thirty years afterwards. The defenders of the hypothesis that knowledge wholly results from the experiences of the individual, ignoring as they do that mental evolution which is due to the autogenous development of the nervous system, fall into an error as great as if they were to ascribe all bodily growth to exercise, and none to the innate tendency to assume the adult form. Were the infant born with a mature-sized and completely-constructed brain, their arguments would have some validity. But, as it is, the gradually-increasing intelligence displayed throughout childhood and youth, is in a much greater degree due to the completion of the cerebral organization, than to the individual experiences—a truth clearly proved by the fact, that in adult life there is often found to exist a high endowment of some faculty which, during education, was never brought into play. Doubtless, the individual experiences furnish the concrete materials for all thought; doubtless, the organized and semi-organized arrangements existing among the cerebral nerves, can give no knowledge until there has been a presentation of the external relations to which they correspond; and doubtless, the child's daily observations and reasonings have the effect of facilitating and strengthening those involved nervous connections that are in process of spontaneous evolution: just as its daily gambols aid the growth of its limbs. But this is quite a different thing from saying that its intelligence is wholly *produced* by its experiences. That is an utterly inadmissible doctrine—a doctrine which makes the presence of a brain meaningless—a doctrine which makes idiotcy unaccountable.

In the sense, then, that there exist in the nervous system certain pre-established relations answering to relations in the environment, there is truth in the doctrine of "forms of thought"—not the truth for which its advocates contend, but a parallel truth. Corresponding to absolute external relations, there are developed in the nervous system absolute internal relations—relations that are developed before birth; that are antecedent to, and independent of, individual experiences; and that are automatically established along with the very first cognitions. And, as here understood, it is not only these fundamental relations which are thus pre-determined; but also hosts of other relations of a more or less constant kind, which are congenitally represented by more or less complete nervous connections. On the other hand, I hold that these pre-established internal relations, though independent of the experiences of the individual, are not independent of experiences in general; but that they have been established by the accumulated experiences of preceding organisms. The corollary from the general argument that has been elaborated, is, that the brain represents an infinitude of experiences received during the evolution of life in general: the most uniform and frequent of which, have been successively bequeathed, principal and interest; and have thus slowly amounted to that high intelligence which lies latent in the brain of the infant—which the infant in the course of its after life exercises and usually strengthens or further complicates—and which, with minute additions, it again bequeaths to future generations. And thus it happens that the European comes to have from twenty to thirty cubic inches more brain than the Papuan. Thus it happens that faculties, as that of music, which scarcely exist in the inferior human races, become congenital in the superior ones. Thus it happens that out of savages unable to count even up to the number of their fingers, and speaking a language containing only nouns and verbs, come at length our Newtons and Shakspeares.

CHAPTER VIII.

THE FEELINGS.

§ 198. The assertion that those psychical states which we class as feelings, are involved with, and inseparable from, those which we class as purely intellectual processes—that they form but another aspect of the mental phenomena already described; is an assertion that will appear untenable. Habitually contemplating the contrast between the cognitive and emotive faculties from a subjective point of view, we conclude that it is a strongly marked contrast; and to say that there is really no line of demarcation between reason, and sentiment or passion, will, by most, be thought a contradiction of direct internal perceptions. Nevertheless, if the general doctrines that have been enunciated are true—if all mental phenomena are incidents of the correspondence between the organism and its environment; and if this correspondence is a thing of degree, which passes insensibly from its lowest to its highest forms; then, we may be certain, *à priori*, that the Feelings are not, scientifically considered, divisible from other phenomena of consciousness. We may infer that they must arise gradually out of the lower forms of psychical action, by steps such as those leading to the higher forms of psychical action already traced out; and that they must constitute another aspect of these. This is just what we shall find. We shall find that Feeling becomes nascent at the same time that Memory and Reason do. We shall find that as, when more complex and less frequent correspondences come to be effected, the internal actions effecting them become less automatic; as, in ceasing to be automatic, they necessitate a previous representation of the motions about to be performed and the

impressions about to be experienced, and thus involve at once both Memory and Reason; so, in this same previous representation, they simultaneously involve the germ of what we call the Feelings. And we shall find, that as, in the beginning, Memory, Reason, and Feeling, are different sides of the same psychical phenomenon; so, though by the continuous differentiation which accompanies development, they become more distinguishable, yet they never cease to stand in this same fundamental relation.

Before proceeding to show this synthetically, it may be well to remark, that even from the ordinary point of view, the impossibility of dissociating the psychical states which we class as intellectual from those which we class as emotional, may be clearly discerned. While we continue to compare such extreme forms of the two as an inference and a fit of anger, we may fancy that they are entirely distinct. But if we compare a variety of modes of consciousness, we shall quickly find some which are clearly both cognitive and emotive. Take, as an example, the state of mind produced by seeing a beautiful statue. Primarily, this is a continuous perception —a co-ordination of the various visual impressions which the statue gives, and a consciousness of what they mean; and this is what we class as a purely intellectual act. But it is impossible to perform this act without a greater or less feeling of pleasure—without some emotion. Should it be said that this emotion results from the many ideas associated with the human form; the rejoinder is, that though these may aid in producing it, it cannot be altogether so accounted for: seeing that we feel a similar pleasure on contemplating a fine building. If it be urged that, even in this case, collateral states of consciousness are induced which suffice to explain the emotion; then, what will be said of the gratification given on looking at a simple curve—an ellipse or parabola? And if, in these instances, there is manifest difficulty in disentangling the cognitive from the emotive; in others, there is an absolute impossibility of doing it. Not only is it, that

in the states of consciousness produced by music the two are inseparably united; but it is, that the state of consciousness produced by a single beautiful tone, presents cognition and emotion fused into one. Not only is it, that a combination of colours, as in a landscape, cannot be perceived without pleasure; but it is, that there is pleasure accompanying the perception of even one colour, when of great purity or brilliance. Nay, even a perfectly smooth or soft surface cannot be presented or represented to consciousness without a certain agreeable feeling resulting. In brief;—seeing that in all cases, the materials dealt with in every cognitive process, are either sensations, or the representations of them; and seeing that these sensations, and by implication the representations of them, are always in some degree agreeable or disagreeable; it follows, of necessity, that no act of cognition can be *absolutely* free from emotion, but that the emotion accompanying it will be strong or weak, according as the materials co-ordinated in the cognition are great or small in quantity or intensity. While, conversely, seeing that every emotion involves the presentation or representation of objects and actions; and seeing that the perceptions, and by implication the recollections, of objects and actions, all imply cognitions; it follows, of necessity, that no emotion can be *absolutely* free from cognition, but that the quantity of cognition involved in it, will vary according to the complexity of co-ordination subsisting among the elements of the emotion.

But the facts that all cognition implies emotion, and all emotion implies cognition, are most clearly discerned on studying the relation between perception and sensation, which are the simplest forms of the two. As was shown in a previous part of this work (§ 79), while perception and sensation can neither of them exist without the other—while every sensation, to be known as one, must be perceived, and must so be in one respect a perception; and while every perception must be made up of combined sensations, and must so be in one respect sensational—the two differ in this; that whereas in

sensation, consciousness is occupied with certain affections of the organism, in perception, consciousness is occupied with the relations subsisting among those affections. In other words;—sensations are the primary undecomposable states of consciousness, while perceptions are those secondary decomposable states consisting of the changes from one primary state to another; and as the continuance of the primary states is inconsistent with the occurrence of changes, it follows that consciousness of the changes is in antagonism with consciousness of the states between which they occur: whence it results, that perception and sensation are, as it were, ever tending to exclude each other, but never succeeding. Indeed, consciousness continues only in virtue of this conflict. Without the primary affections of consciousness, there can be no changes from one primary affection to another: and without changes from one to another, there can be no primary affections; seeing that in the absence of changes consciousness ceases. But, while neither consciousness of the changes, nor of the affections between which they occur, can exist by itself; yet, either may so predominate as completely to subordinate the other. When the changes are very rapid, and the states forming their antecedents and consequents do not last for any appreciable time, consciousness is almost wholly occupied with changes; that is, with the relations among the sensations: the sensations are only so far present as is needful for the establishment of relations among them; and we have that condition of consciousness known as perception. Conversely, when the states forming the antecedents and consequents of the changes, have considerable persistence—when the changes are comparatively slow, or more probably, when the affections of consciousness are not permanently destroyed by the changes, but continually return, and are thus only broken by the changes so far as is needful to maintain consciousness—when therefore, some one state of consciousness by its continuous recurrence, greatly predominates over others; then there arises what we distinguish as a sensation.

Now, this is just the relationship which exists throughout between knowing and feeling. Though differing from Sir William Hamilton respecting the interpretation of the antagonism between perception and sensation, I quite agree with him in the doctrine, that the same antagonism holds between cognition and emotion in general. Indeed, our ordinary forms of speech may be quoted in support of such a generalization. The word *feeling*, which we apply to every species of emotion, primarily expresses sensation; and we use the word *perceive*, not only in respect to cognitions gained through the senses, but in respect to all orders of cognitions. The differences are simply differences that arise from successive complications. As, out of those simplest perceptions forming the lowest class of cognitions, the higher cognitions result by the compounding of perceptions—by an advance from single relations, to relations of relations, and to relations of relations of relations; so, out of those simplest sensations forming the lowest class of feelings, the higher feelings arise by the compounding of sensations—by an advance from single sensations, to those produced by groups of sensations and the relations among them, and to those produced by groups of such groups. And just as, by the complication of cognitions, the elements involved become too numerous to be all present together, and so become partly representative, and afterwards sometimes wholly representative; so, by the complication of the emotive states of consciousness, the elements involved become too numerous to be all present together, and so become partly representative and afterwards sometimes wholly representative. But these positions call for some elucidation.

It has been from time to time pointed out, and is indeed familiar to all acquainted with the rudiments of the subject, that in the development of intelligence, there is a progressive consolidation of states of consciousness. States of consciousness once separate, become indissociable. Other states that were originally united with difficulty, become so coherent as to follow one another without effort. And thus it results that

there arise large aggregations of states, answering to complex external things—animals, men, buildings—which are so fused together as to be practically single; and which thus enable us to recognize such complex external things by the briefest glance. Indeed, that these aggregations should be formed, should become ever more consolidated, should by coalescing with each other produce still larger aggregations, and so on without limit, is an unavoidable corollary from the experience-hypothesis, as interpreted in the foregoing chapters. But one of these compound states of consciousness, by uniting, as it does, a large number of sensations and the relations among them into one state, does not by so doing destroy them. Though subordinated as parts of a whole, they still severally exist as states of consciousness. And being severally in their original forms, *feelings*, it results that this state which is composed of them is a *feeling*—a feeling produced by the fusing of a number of minor feelings. Hence results the gratification given to the child by every new object it sees. Hence the pleasure accompanying all kinds of perceptions, so long as they are not carried to the extent of satiety. Not only, however, does this hold with unions of the simple sensations into those groups constituting the perceptions of objects; but it holds with unions of these groups into still larger groups. When such composite states of consciousness as those answering to single complex objects, become sufficiently consolidated; then, if there happen to be within the range of the daily experiences, any constant assemblage of such objects, as those distinguishing a particular locality, there results a consolidation of these composite states into a still larger aggregation of states: the feelings severally constituted by these composite states, are, in their turn, merged into a more complex feeling—a feeling which is produced by being in that locality, and so constitutes a liking for that locality. And then from the union of this complicated state of consciousness with certain other complicated ones, such as those implied in the domestic relations, there results a state of consciousness even still more compli-

cated, which answers to the idea, home; and the feeling constituted by this state of consciousness, we call a love of home. But now let it be remarked, that as fast as these compound states of consciousness in their ascending grades, severally become, by the close combination of their elements, practically single; so fast do they begin to play the same part in the mental processes as single states do. And hence results the fact, that the above described law of antagonism between perception and sensation, holds between cognition and feeling in general. As we saw that the continuance of a sensation is inconsistent with the occurrence of a change, and that hence consciousness of changes, or relations among sensations, is ever at variance with consciousness of the sensations; so, it must happen, that in proportion as a complex consciousness including many sensations and relations, becomes fused into one, its continuance must similarly be at variance with the occurrence of a change to some other such state; that is—must be at variance with the establishment of a relation between the thing causing such composite state, and anything else; that is—must be at variance with cognition. And hence arises the fact which all persons analytically inclined will have remarked, that in proportion as they think about any gratification they are receiving—speculate upon the cause of it, or criticise the object of it—in the same proportion does the gratification cease.

These several expositions having, as I think, pretty clearly shown the inseparableness of the intellectual and emotional elements of mind; having shown that they are but different aspects of the same development, and may so be expected to arise from the same root by the same process; we may now go on to consider the feelings synthetically.

§ 199. So long as the actions are perfectly automatic, feeling does not exist. Of this we have several proofs. We have the proof that in the creatures most markedly exhibiting them, automatic actions go on equally well when the chief nervous centre has been removed. We have the proof that the actions

which in ourselves are entirely automatic—which are in no degree subject to voluntary control, are unaccompanied by feeling; as witness the actions of the viscera in their normal state. And we have the further proof that the actions which in ourselves are partly voluntary, partly reflex—as that by which the foot is withdrawn from scalding water—and which, so long as they are accompanied by feeling, are accompanied by will, show a much stronger automatic character when feeling disappears: when, from injury of the sentient nerves, there is an entire loss of sensibility in a limb, the slightest stimulus, as even the touch of a feather, produces reflex movements that are far more vehement than those produced in a limb retaining its sensibility.

This general fact, that automatic action and feeling are antagonistic, will be better understood on observing that feeling necessarily involves a certain continuity of some psychical state. To be conscious of any feeling, is to have the state of consciousness signified by the name of that feeling. But to have a state of consciousness, appreciable as such, implies some duration of that state. In proportion as a state is greatly elongated—in proportion as it occupies consciousness for a long time, in the same proportion does it become a distinct feeling; and in proportion as it is greatly abbreviated—in proportion as it makes a smaller and smaller figure in the chain of states of consciousness, in the same proportion does it lapse out of consciousness, in the same proportion does it cease to be felt. The statement is in fact a truism. To say that a state of consciousness has considerable continuity, is to say that it is a distinct element of consciousness; which is the same thing as being known or felt. To say that it has scarcely any continuity, is to say that it forms a scarcely perceivable element in consciousness; which is the same thing as being scarcely at all known or felt. And to say that it is a state of consciousness having no appreciable length, is to say that it forms no element in consciousness; which is the same thing as saying that it is not known or felt. Should it be needed,

confirmation for this view will be found in the ordinary experience that every species of sensation or emotion involves time. Nothing can be tasted or smelt instantaneously. A momentary glance at a fine colour does not suffice to give us the pleasurable sensation produced by such colour, but merely to give us a knowledge of what colour it was. For the beauty of a tone to be appreciated it must have some persistency. And with all the more complex emotions produced by music, or landscape, or poetry, or the arts, it is needful that the things producing them should be *dwelt* upon. It follows, therefore, that when a set of psychical changes occurs instantaneously, the several psychical states forming the antecedents and consequents of the changes, are not felt; and the further the consolidation of any set of psychical changes is carried, the more complete must be the absence of feeling. Now the completely consolidated sets of changes are the automatic changes. The automatic changes are those whose elements are absolutely coherent—are practically fused into one change: so fused that as soon as one component of the group occurs, the rest instantaneously occur. And thus it results, that while all the psychical actions are perfectly automatic, there is no feeling.

An entire absence of Memory and Reason, then, is accompanied by an entire absence of Feeling. And the same progress which gives origin to Memory and Reason, simultaneously gives origin to Feeling. For what did we find to be the circumstances under which Memory and Reason become nascent? We found that when, in the course of the general evolution of Life, the correspondence has attained to a considerable degree of complexity; when the adjustment of inner to outer relations begins to take in comparatively involved and infrequent groups of outer relations; when, by consequence, the answering groups of inner relations are made up of many elements, some of which are not often repeated in experience; when, therefore, there arise groups of inner relations whose components are imperfectly coherent; when conflicting tendencies among some of the psychical changes arise, and they severally

become nascent before certain of them occur; when thus there come to be hesitating and imperfect automatic actions; then, Memory and Reason simultaneously become nascent. The ceasing to be automatic and the becoming rational, are, as we saw, the same thing. We have just seen, however, that when psychical changes are perfectly automatic, they are without feeling. The existence of feeling we have seen to imply psychical states having some persistency—states that do not succeed one another instantaneously. And states that do not succeed one another instantaneously, are the states which result on the cessation of automatic action: the cessation of automatic action *is* the occurrence in the nervous centres of certain states that are not immediately followed by the appropriate motor changes—states that have some persistency. Thus then, as the psychical changes become too complicated to be perfectly automatic, they become incipiently sensational. Memory, Reason, and Feeling take their rise at the same time. And it is not simply that they all commence as automatic action ceases; but it is that the commencement of them and the cessation of automatic action are one and the same thing—are different aspects of the same progress.

A strong confirmation of this view, parallel to confirmations given in the two preceding chapters, is supplied by the fact, that in ourselves, psychical processes which were once slow, and were then accompanied by feeling, are by much repetition not only rendered automatic, but by the same process are rendered indifferent or feelingless. This is equally the case whether the accompanying feelings are painful or pleasurable. In spelling out its reading-lessons, the child experiences a more or less disagreeable sense of effort; but in the adult, the identification of words is a totally unemotional process. The learning of a new language requires labour that is more or less unpleasant, and the first attempts to speak it soon produce weariness; after due practice, however, it is spoken with entire indifference. And without multiplying illustrations, I may quote the general truth that habit renders easy the actions that

once were hard, as showing that this law holds throughout: seeing that by calling actions *hard*, we mean, to some extent painful; and that becoming *easy*, is ceasing to be painful. Conversely, in the equally general truth that custom produces satiety — that the keenness of any species of gratification diminishes in proportion as it becomes familiar, we have the law similarly illustrated. So long as the combinations of properties they present are new to it, the commonest objects give pleasure to the infant: but as fast as, by constant repetition, the compound impressions produced become consolidated into perfect cognitions of the objects—become so automatically connected that the briefest glance suffices instantly to bring before the mind all the conjoined attributes and relations—so fast do the objects become indifferent. Throughout childhood, youth, and manhood, the same fact is daily manifested. The often repeated groups of psychical changes become indifferent; and there arises a constant demand for those that have not been experienced, or have been little experienced. And we may even trace the law in the fact, that things to which we have become indifferent re-acquire their attractions after an interval of disuse—that music, friends, home, are enjoyed with increased zest after absence: seeing that as, by daily repetition, any group of psychical changes approximates more and more to the automatic; so, by an entire cessation of the daily repetitions, they begin to lose somewhat of the automatic character they have acquired.

Thus, as we found that not only do Memory and Reason arise when the psychical changes cease to be automatic, but that where they have existed they disappear when, by perpetual repetition, the psychical changes become automatic; so, we find that not only does Feeling arise under the same conditions, but that it ceases under the same conditions.

Let us now, however, consider the genesis of the Feelings somewhat more closely.

§ 200. When, as before explained in describing nascent Me-

mory and Reason, there results from their growing complexity a certain hesitation in the automatic actions—when there come to be cases in which two involved groups of external relations that are much alike, have been followed in experience by different motor changes; and when there consequently arises on the presentation of one of these groups, a conflict among the two sets of motor changes, which severally become nascent but are prevented by their mutual antagonism from at once taking place; then, while one of these nascent sets of motor changes and the impressions habitually accompanying it, constitutes a memory of such motor changes as before performed and impressions as before received, and while it also constitutes a prevision of the action appropriate to the new occasion—a rational foresight of consequences, it further constitutes the *desire* to perform the action—the impulse prompting to it. To continue the illustration before used:—Suppose the subject of the psychical phenomena we are considering, to have occasional experience of two animals somewhat similar in colour, size, and general contour, one of which serves for prey, and the other of which is a dangerous enemy. The complex impression produced by the enemy, has been followed in experience by injury, by certain defensive actions, perhaps by certain cries, and eventually by flight. That produced by the prey has been followed in experience by the actions of pursuit and attack, by the use of the teeth and claws, by processes of tearing to pieces and swallowing. But these two complex impressions having, as premised, many elements in common, tend, in so far as there is a confusion between them, to arouse either of these two sets of psychical changes; and when one of these animals is seen, each set becomes nascent according as the impression produced varies. At one moment the defensive actions, the cries, and the movements of escape, which have before followed some such impression as that received, tend to arise; and the next moment a change in the position of the animal so alters the impression, as partially to excite the psychical states involved in pursuit, attack, de-

stroying, and devouring. But what is either of these partial excitations? It is nothing else than an impulse, an emotion, a feeling, a desire. To have in a slight degree those psychical states accompanying the reception of wounds, those which express themselves in cries, those which are experienced during flight, is to be in a state of what we call fear. And to have in a slight degree those psychical states involved in the processes of catching, killing, and eating, is to have the desires to catch, kill, and eat. That the propensities to the acts are nothing else than nascent excitations of the psychical states involved in the acts, is clearly proved by the natural language of the propensities. Fear, when strong, expresses itself in cries, in efforts to hide or escape, in palpitations and tremblings; and these are just the manifestations that would accompany an actual experience of the evil feared. The destructive passions are shown in a general tension of the muscular system, in gnashing of the teeth and protrusion of the claws, in dilated eyes and nostrils, in growls; and these are weaker forms of the actions that accompany the killing of prey. To such objective evidences, every one can add subjective ones from his own experience. Every one can testify that the psychical state which we call fear, consists of mental representations of certain painful results; and that the one we call anger, consists of mental representations of the actions and impressions which would occur while inflicting some kind of pain upon another: or, in other words, that these passions are partial excitations of those states involved in the reception or infliction of injury. And so with the passions in general.

Possibly it may be objected, that to describe the nascent group of psychical changes produced by some complex impression, as constituting at the same time a memory of the the psychical changes which had before followed this impression and a desire again to go through those changes, is absurd; seeing that the subject-matter of memory is retrospective, while that of desire is prospective. The reply is, that though, when a high degree of intelligence has been

attained to, these nascent changes are accompanied by a consciousness of time past and time future, and so come to have different aspects; yet, at the stage in which automatic action merges into the higher forms of action, no such abstract conception as that of Time can exist, and no such duality of aspect in these groups of nascent psychical changes can arise. And a further reply is, that even in ourselves, any group of nascent psychical changes, however much they may be represented in consciousness as prospective, are nevertheless, at the same time retrospective: seeing that they cannot be represented at all unless they have been previously presented in experience; and the representation of them is the same thing as a memory of them.

§ 201. The progress from the initial forms of feeling to those complicated forms of it seen in human beings, equally harmonizes with the general principles of evolution that have been laid down. Arising, as it does, when the automatic actions, from increasing complexity and decreasing frequency, become hesitating; and consisting, as it then does, of nothing more than the group of sensations received and the nascent motor changes aroused by them; feeling, step by step developes into larger and more varied aggregations of psychical states—sometimes purely impressional, sometimes nascently impressional or ideal; sometimes purely motor, sometimes nascently motor; but very frequently including in one combination, immediate impressions and the ideas of other impressions, with immediate actions and the ideas of other actions. And this formation of larger and more varied aggregations of psychical states, necessarily results from the accumulating cohesions of psychical states that are connected in experience. Just as we saw that the advance from the simplest to the most complex forms of cognition, was explicable on the principle that the outer relations produce the inner relations; so, we shall see that this same principle supplies an explanation

of the advance from the simplest to the most complex feelings.

For when the development of Life reaches this repeatedly described stage, in which the automatic actions merge into the actions that are at once conscious, rational, and emotive; what must be the effect of further experiences? The effect must be that if, in connection with a group of impressions and the nascent motor changes resulting from it, there is habitually experienced some other impression or motor change; this will, in process of time, become so coherent to the group, that it too will become nascent where the group becomes nascent, or will render the group nascent if it is itself induced. If, along with the running down and laying hold of certain prey, there has always been experienced a certain scent; then, the presentation of that scent will render nascent the motor changes and impressions that accompany the running down and laying hold of the prey. If the motor changes and impressions that accompany the catching of prey, have been habitually followed by those bitings, and strugglings, and growlings, accompanying the destruction of prey; then, when they are rendered nascent, they will in their turn render nascent the psychical states implied in bitings, strugglings, and growlings. And if these have similarly been followed by those involved in eating; then those involved in eating will also be made nascent. Thus, the simple olfactory sensation will make nascent those numerous and varied states of consciousness that accompany the running down, catching, killing, and eating of prey: the sensations, visual, aural, tactual, olfactory, gustatory, muscular, constantly accompanying the successive phases of these actions, will be all partially aroused at the same time—will be present to consciousness as what we call ideas—will, in their aggregate, constitute the desires to catch, kill, and devour—and will, in conjunction with that olfactory sensation which aroused them all, form the motor impulse which sets going the limbs in pursuit.

Evidently the entire genesis of these complex feelings, results from successive complications in the groups of psychical states that are co-ordinated; and is just as much determined by experience, as is the union of any two simple sensations that constantly occur together.

Not only are those emotions which form the immediate stimuli to actions, thus explicable; but the like explanation applies to the emotions that leave the subject of them comparatively passive: as, for instance, the emotion produced by beautiful scenery. The gradually increasing complexity in the groups of sensations and ideas co-ordinated, ends in the co-ordination of those vast aggregations of them which a grand landscape excites and suggests. The infant taken into the midst of mountains, is totally unaffected by them; but is delighted with the small group of attributes and relations presented in a toy. The child can appreciate, and be pleased with, the more complicated relations of household objects and localities, the garden, the field, and the street. But it is only in youth and mature age, when individual things and small assemblages of them have become familiar and automatically cognizable, that those immense assemblages which landscapes present can be adequately grasped, and the highly aggregated states of consciousness produced by them, experienced. Then, however, the various minor groups of states that have been in earlier days severally produced by trees, by fields, by streams, by cascades, by rocks, by precipices, by mountains, by clouds, are aroused together. Along with the sensations immediately received, there are partially excited the myriads of sensations that have been in times past received from objects such as those presented; further, there are partially excited the various incidental feelings that were experienced on all these countless past occasions; and there are probably also excited certain deeper, but now vague combinations of states, that were organized in the race during barbarous times, when its pleasurable activities were chiefly among the woods and waters. And out of all these excitations, some of them actual, but most of them

nascent, is composed the emotion which a fine landscape produces in us.

§ 202. One of the several corollaries following from the foregoing doctrines, is, that other things equal, the emotions are strong in proportion as they include a large number of actual sensations, or nascent sensations, or both. As every one of the elementary states of consciousness aggregated together in the way described, is originally a feeling of some kind or other; as the progressive consolidation of groups of such states, though it tends more and more to abbreviate the elementary states, yet never wholly obliterates them; and as each of the elementary states therefore remains to the last a feeling, however infinitesimal in amount; it follows that the greater the accumulation of such infinitesimal amounts of feeling, the greater must be the sum total of feeling experienced. And this is just what we find to be the fact. Strength of feeling is of two kinds: that which results from intense excitation of few nerves; and that which arises from slight excitation of many nerves. Thus, on the one hand, the tip of a finger cannot be held in boiling water without an unbearable sensation being produced; and, on the other hand, though there is no difficulty in holding the tip of a finger in water above 100° of Fahrenheit, yet an unbearable sensation is produced if the whole body be plunged into water of that temperature: whence it is manifest, that the moderate excitation of all the nerves distributed over the surface of the body, is equivalent in effect to the extreme excitation of a few of them. Again, though a very faint colour cannot be discerned when it extends over a very minute surface; yet, the same colour extended over a great surface is discerned with ease. And that the truth which thus holds with actual sensations, holds also with those nascent sensations which, as aggregated in the form of groups of ideas, constitute the emotions, will be manifest on calling to mind how actions are continually determined by the accumulation of motives; that is, by the accumulation of such nascent excitations.

From this corollary it is a second corollary, that, with a certain qualification to be hereafter made, the further the development is carried the stronger do the emotions become: seeing that as the increasingly complex emotions successively developed, arise by the aggregation of previous groups of actual and nascent sensations into yet larger groups, the resulting totals must become continually larger. As supplying a marked illustration of this truth, I may cite the passion which unites the sexes. This is habitually, but very erroneously, spoken of as though it were a simple feeling; whereas it is in fact the most compound, and therefore the most powerful, of all the feelings. Added to the purely physical elements of it, are first to be noticed those highly complex impressions produced by personal beauty; around which are aggregated a variety of pleasurable ideas, not in themselves amatory, but which have an organized relation to the amatory feeling. With this there is united the complex sentiment which we term affection—a sentiment which, as it can exist between those of the same sex, must be regarded as in itself an independent sentiment; but which assumes its highest activity between lovers. Then there is the sentiment of admiration, respect, or reverence; in itself one of considerable power, and which in this relation becomes in a high degree active. Next there must be added the feeling which phrenologists have named love of approbation. To be preferred above all the world, and that by one admired beyond all others, is to have the love of approbation gratified in a degree passing every previous experience: especially as, to this direct gratification of it, there must be added that reflex gratification of it which results from the preference being witnessed by unconcerned persons. Further, there is the allied emotion of self-esteem. To have succeeded in gaining such attachment from, and sway over, another, is a practical proof of power, of superiority, which cannot fail agreeably to excite the *amour propre*. Yet again, the proprietary feeling has its share in the general activity: there is the pleasure of possession; the two belong to each other—claim each other as a species of property.

Once more, there is involved an extended liberty of action. Towards other persons a restrained behaviour is requisite: round each there is a certain subtle boundary which may not be crossed—an individuality on which none may trespass. But in this case the barriers are thrown down; the freedom of another's individuality is conceded; and thus the love of unrestrained activity is gratified. Finally, there is an exaltation of the sympathies: purely personal pleasures are doubled by being shared with another; and the pleasures of another are added to the purely personal pleasures. Thus, round the physical feeling forming the nucleus of the whole, there are gathered the feelings produced by personal beauty, that constituting simple attachment, those of reverence, of love of approbation, of self-esteem, of property, of love of freedom, of sympathy. All these, each excited in the highest degree, and severally tending to reflect their excitement on each other, form the composite psychical state which we call love. And as each of these feelings is in itself highly complicated, uniting a wide range of states of consciousness, we may say that this passion fuses into one immense aggregation, nearly all the elementary excitations of which we are capable; and that from this results its irresistible power.

But the progressive evolution of emotions of higher complexity and greater power, produces other emotions than those which arise by the simple aggregation of large groups of psychical states into still larger groups; in correspondence with those connections which in the environment unite into still larger groups of phenomena, the large groups of phenomena which occur in habitual coexistence or sequence. There is, at the same time, and as a result of the same cause, an evolution of emotions that are not only more complex, but also more abstract. Of this, the love of property supplies an example. When the intelligence is so far developed that time and locality are in some degree cognizable; and when, by consequence, a portion of food beyond what can be eaten at one time, can, when hunger next makes nascent the psychical states that

accompany eating, be remembered as having been left in a particular place; there will, by a repetition of these experiences of a satiated hunger, and a subsequently recurring hunger that prompts a return to the remaining food, be established an organized connection between the consciousness of such remaining food and the various states of consciousness produced by a return to it: and there will thus be constituted an anticipation of a return to it—a tendency to perform all such actions accompanying return to it as are not negatived by the present satiety—a tendency, therefore, to take possession of it. By an analogous process there will be established a tendency to take possession of some habitual place of shelter; and afterwards to take possession of things serving for artificial shelter and for clothing. By a gradual transition, things indirectly connected with personal welfare must come to be included: as, for example, the club used for a weapon; the impressions produced by which will make nascent the various impressions that have accompanied its use, and the conception of further use. And by a carrying of the same process to still higher complications, there will arise a propensity to take possession not only of various weapons and appliances of daily life, but also of the tools and materials required to make such weapons and appliances; afterwards of the materials required to make such tools; and so on to all degrees of remoteness: until the things accumulated for one purpose or other become extremely numerous and varied. But now observe that in proportion as these things become extremely numerous and varied; and in proportion as the acts of acquiring them and preserving them become frequent; there will, in conformity with the general law, be established a great variety of different excitements in connection with the act of taking possession or holding possession: and hence this act will itself become a source of excitement. And as the excitement thus caused, must be more habitual than that caused by any particular order of object; as, further, the special excitements attaching to special objects possessed, must, in virtue of their variety,

prevent the excitement of possession from being connected with any one of them in particular; it results that the excitement of possession becomes one of a new kind, holding a great variety of excitements to which it ministers, in an accumulated but vague aggregation. And when, in the course of civilization, money comes to be the representative of value in general—value as abstracted from special objects—we see, in the miser, how the desire of possession in the abstract, may become almost independent of those from which it arose; and may become stronger than any one of them individually.

As still further illustrating the origin and nature of the more abstract emotions, I may instance one still in process of evolution among civilized men; and as yet but very imperfectly developed: I refer to the love of liberty, the sentiment of personal rights. Just the same relation which the love of property bears to the various gratifications it provides for, the love of unrestricted action bears to the gratifications derivable from property and from all other things. As the one secures the *material objects* directly or indirectly ministering to life, the other secures those *non-material conditions* without which the material objects can neither be obtained, nor preserved, nor used. While the possession of certain kinds and combinations of *matter* is a very general pre-requisite to the fulfilment of the desires; a still more general, and indeed universal, pre-requisite, is, that freedom of *motion* without which it is not only impossible to obtain and use such matter, but is impossible to perform any action whatever. This sentiment of personal rights, answering to certain highly complex relations in which men living in a society stand to each other—being a gratification in the maintenance of such relations with other men as admit of an unrestricted activity—is manifestly far more abstract and more general in its scope than any other. It is manifestly one which could not begin to be organized until mankind grew into definite and permanent social relations. As uniting in one general sentiment, the desire for liberty of person, liberty of acquisition and possession, liberty

of movement from place to place, liberty of speech, liberty of trade, and so on, it supposes an extremely extensive aggregation of psychical states. And it manifestly has long been in process of development.

It only remains to add here the qualification, which, as above said, must be made to the assertion that the feelings grow in power as they increase in complexity. For though, other things equal, the power of a feeling is proportionate to the number of elementary states of consciousness united in it; yet, other things are *not* always equal. Along with greatness of number there may be lowness of intensity. Where, as in the above case, the connexions established in experience are extremely intricate, comparatively infrequent, and very varied, the co-ordination of the states is so weak that they do not render one another nascent with much vividness; and hence, the total effect is in many cases less than that produced by a smaller aggregation more strongly excited. Nevertheless, the slow organization of experiences will, in process of time, compensate for this; and ultimately the sentiment of personal rights will yield to none in strength.

§ 203. After what was said at the close of the last chapter, I need hardly say that this evolution of the feelings, through the progressive aggregation of psychical states that are connected in experience, is to be understood as taking place in countless successive generations. The law of development of the mental activities as regarded under their cognitive aspect, equally applies to them as regarded under their emotional aspect. That gradual organization of forms of thought which we saw must result from the experience of uniform external relations, must be accompanied by the organization of forms of feeling similarly resulting. These, in their more complex phases, differ simply in this, that the aggregations of external attributes and relations to which they answer, are immensely more extensive, far more concrete, and known but empirically. Given a race of organisms placed in habitual contact with any complex set of circumstances, and, if its members are already able to cognize

the various minor groups of phenomena composing this set of circumstances, there will slowly be established in them a co-ordination of psychical states corresponding to this set of circumstances. By the accumulation of small increments, arising from the constant experiences of successive generations, the tendency of all the component psychical states to make each other nascent, will become gradually stronger. And when ultimately it becomes organic, it will constitute what we call a sentiment, or propensity, or feeling, having this set of circumstances for its object.

That the experience-hypothesis, as ordinarily understood, is inadequate to account for emotional phenomena, will be sufficiently manifest. If possible, it is even more at fault in respect to the emotions than in respect to the cognitions. The doctrine maintained by some philosophers, that all the desires, all the sentiments, are generated by the experiences of the individual, is so glaringly at variance with hosts of facts, that I cannot but wonder how any one should ever have entertained it. Not to dwell on the multiform passions displayed by the infant, before yet there has been such an amount of experience as could by any possibility suffice for the elaboration of them; I will simply point to the most powerful of all passions—the amatory passion—as one which, when it first occurs, is absolutely antecedent to all relative experience whatever.

§ 204. And here this doctrine of the hereditary transmission of tendencies towards certain complex aggregations of psychical states corresponding to complex aggregations of external phenomena, and the consequent organization of such tendencies in the race, suggests a few remarks on the tenets of the phrenologists.

That an organized tendency towards certain complex aggregations of psychical states, supposes a structural modification of the nervous system—a special set of complex nervous connections whereby the numerous excitations constituting the emotion may be co-ordinated—no one having even a superficial knowledge of Physiology can doubt. As every student of the

nervous system knows, the combination of any set of impressions, or motions, or both, implies a ganglion in which the various nerve-fibres concerned are put in connection. To combine the actions of any set of ganglia, implies some ganglion in connection with them all. And so on in ever-ascending stages of complication: the nervous masses concerned, becoming larger in proportion to the complexity of the co-ordinations they have to effect. The induction that the same thing holds throughout, is, I think, irresistible. And if so, it follows that every emotion implies some portion of nervous structure by which its various elements are united—a portion which is large in proportion as these elements are many and varied; and which, in virtue of its co-ordinating function, is more especially the seat of the emotion.

That, in their antagonism to the unscientific reasonings of the phrenologists, the physiologists should have gone to the extent of denying or ignoring any localization of function in the cerebrum, is, perhaps, not to be wondered at: it is in harmony with the course of controversies in general. But no physiologist who calmly considers the question in connection with the general truths of his science, can long resist the conviction that different parts of the cerebrum subserve different kinds of mental action. Localization of function is the law of all organization whatever: separateness of duty is universally accompanied with separateness of structure: and it would be marvellous were an exception to exist in the cerebral hemispheres. Let it be granted that the cerebral hemispheres are the seat of the higher psychical activities; let it be granted that among these higher psychical activities there are distinctions of kind, which, though not definite, are yet practically recognizable; and it cannot be denied, without going in direct opposition to established physiological principles, that these more or less distinct kinds of psychical activity must be carried on in more or less distinct parts of the cerebral hemispheres. To question this, is not only to ignore the truths of physiology as a whole; but especially

those of the physiology of the nervous system. It is proved experimentally, that every bundle of nerve-fibres and every ganglion, has a special duty; and that each part of every such bundle and every such ganglion, has a duty still more special. Can it be, then, that in the great hemispherical ganglia alone, this specialization of duty does not hold? If it be urged that there are no marked divisions among the fibres of the cerebrum, I reply—neither are there among those contained in one of the bundles proceeding from the spinal chord to any part of the body: yet each of the fibres in such bundle has a function more or less special; though a function included in that of the bundle considered as a whole. And this is just the kind of specialization which may be presumed to exist in different parts of the cerebrum. Just as there are aggregated together in a sciatic nerve, a great number of nerve-fibres, each of which has a particular office referring to some one part of the leg, but all of which have for their joint duty the management of the leg as a whole; so, in any one region of the cerebrum, each nerve-fibre may be concluded to have some particular office, which, in common with the particular offices of thousands of neighbouring fibres, is merged in some general office which that region of the cerebrum fulfils. Indeed, any other hypothesis seems to me, on the face of it, untenable. Either there is some arrangement, some organization, in the cerebrum, or there is none. If there is no organization, the cerebrum is a chaotic mass of fibres, incapable of performing any orderly action. If there is some organization, it must consist in that same "physiological division of labour" in which all organization consists; and there is no division of labour, physiological or other, of which we have any example, or can form any conception, but what involves the concentration of special kinds of activity in special places.

But to coincide with the doctrine of the phrenologists in its most abstract shape, is by no means to coincide with their concrete embodiments of it. Indeed the erudity of their philo-

sophy is such, as may well make many who to some extent agree with them, refrain from any avowal of their agreement: more especially when they are met by so great an unwillingness to listen to any criticisms on the detailed scheme rashly promulgated as finally settled.

Among other objections to the phrenologists' teachings, it may be noted that they put forth their body of doctrines as in itself a complete system of Psychology. To one who has read thus far, it is needless to point out the absurdity of this position. At best, Phrenology can be but an appendix to Psychology proper; and one of but comparative unimportance, scientifically considered.

Again they are unwarranted in their idea of a *precise* demarcation of the faculties. Were there anything like that definite distinction in the functions of the different parts of the cerebrum, which is indicated by the lines on their busts, and apparently supposed by them really to exist, there would be some signs of it in the cerebrum itself. In other parts of the nervous system, where there is decisive difference of function, there is decisively marked separation of structure. The only localization which we may presume to exist, and which the necessities of the case imply, is one of a comparatively vague kind—one which does not suppose specific limits, but an insensible shading-off. And this is just the conclusion to which all the preceding investigations point. For as we have seen that even mental faculty, rightly understood, is an internal plexus of nervous relations, corresponding to some plexus of relations among external phenomena that are habitually experienced; and as the different plexuses of external relations, in proportion as they become complicated, also become less definite in their distinctions, so that when we reach those extremely involved, extensive, and variable plexuses of relations to which the higher faculties respond, there comes to be a great overlapping and entanglement of the different plexuses; it follows that the answering internal plexuses must be fused together—it must be

as impossible to demarcate the internal nervous aggregations, as it is to demarcate the aggregations of external relations.

Moreover, I conceive that the phrenologists are wrong in assuming that there is something specific and unalterable in the natures of the various faculties. Responding, as these do, to the particular assemblages of phenomena habitually surrounding any race of organisms, they are only so far fixed and specific as these are fixed and specific. A permanent alteration in one of these assemblages, would in time establish a special feeling responding to the modified assemblage. A habit—say of sitting in a particular place in a particular room, and of being uncomfortable elsewhere—is nothing but an incipient feeling answering to that particular group of outer relations; and were all the successors of the person having this habit, to be constantly placed in the same relations, this incipient feeling would become an established one. So little specific are the faculties, that no one of them is quite the same in different persons: they severally differ as the several features differ.

Yet further, the current impression of phrenologists seems to be, that the different portions of the cerebrum in which they locate different faculties, are of themselves competent to produce the manifestations assigned to them. The portion of brain marked "acquisitiveness," is supposed to be alone concerned in producing the desire of possession. But it is a corollary from the general argument of this chapter, that the desire includes a great number of minor desires elsewhere located. As every more complex aggregation of psychical states, is evolved by the union of minor aggregations previously established—results from the consolidation or co-ordination of these; it follows that that which becomes more especially the seat of this more complex aggregation, or higher feeling, is simply the *centre of co-ordination* by which all the minor aggregations are brought into relation. Hence, that particular portion of the cerebrum in which a particular faculty is said to be located, must be regarded as an agency by which the

various actions going on in other parts of the cerebrum are combined in a particular way.

Saying nothing of the many minor objections that may be made to the phrenological doctrine, in respect of its localizations, and more especially in respect of its very faulty, unanalytical nomenclature of the faculties; it is thus sufficiently clear, that defensible as it is in its fundamental proposition, it is in many other points quite indefensible.

CHAPTER IX.

THE WILL.

§ 205. It must be obvious to all who have followed the argument thus far, that what we call Will, is but another aspect of that same general process whose other aspects have been delineated in the last three chapters. Not only do Memory, Reason, and Feeling, simultaneously arise as the automatic actions become complex, infrequent, and hesitating; but Will arises at the same time, and is necessitated by the same conditions. As the advance from the simple and indissolubly coherent psychical changes, to the psychical changes that are involved and dissolubly coherent, is in itself the commencement of Memory, Reason, and Feeling; so also is it in itself the commencement of Will. On passing from the compound reflex actions to those actions so highly compounded as to be imperfectly reflex—on passing from the groups of psychical changes that are organically connected, and take place with extreme rapidity, to those groups of psychical changes which are not organically connected, and take place with some deliberation, and therefore consciously; we pass to an order of mental action which is one of Memory, Reason, Feeling, or Will, according to the relation in which we consider it.

This is a conclusion of which we may be certain, even in anticipation of any special synthesis. For, as before said, all modes of consciousness can be nothing else than incidents of the correspondence between the organism and its environment; and as such, must be different sides of, or different phases of, the co-ordinated groups of changes whereby inner relations are adjusted to outer relations. Between the reception of certain

impressions and the performance of certain appropriate motions, there is some inward connection. If the inward connection is perfectly organic, the action is of the reflex order, either simple or compound; and none of the phenomena of consciousness proper, exist. If the inward connection is not perfectly organic, then the psychical changes which connect the impressions and motions, are conscious ones; the entire action is a conscious action, and must exhibit all the essential elements of a conscious action: that is—must simultaneously exhibit Memory, Reason, Feeling, and Will; for there can be no conscious adjustment of an inner to an outer relation without all these being involved. But let us consider the matter more nearly.

§ 206. When, as a result of the organization of accumulating experiences, the automatic actions become so involved, so varied in kind, and severally so infrequent, as no longer to be performed with unhesitating precision—when, after the reception of one of the more complex impressions, the appropriate motor changes become nascent, but are prevented from passing into immediate action by the antagonism of certain other nascent motor changes appropriate to some nearly allied impression; there is constituted a state of consciousness which, when it finally issues in action, exhibits what we term volition. Under such conditions, there occurs a conflict between two sets of nascent motor changes; one of which ultimately prevails and passes into a set of actual motor changes. Each set of nascent motor changes arising in the course of this conflict, is a weak form of the state of consciousness which accompanies such motor changes when actually performed—is a representation of such motor changes as before executed under like circumstances—is an idea of such motor changes. We have, therefore, a conflict between certain ideal motor changes which severally tend to become real; and one of which eventually does become real: and this passing of an ideal motor change into a real one, is that which we distinguish as Will. In a voluntary act, considered in its

simplest form, apart from the aggregated states of consciousness eventually constituting the greater part of the motive, we can find nothing beyond a mental representation of the act, followed by a performance of it—a rising of that nascent psychical change which constitutes at once the tendency to act and the idea of the act, into the positive psychical change which constitutes the performance of the act, in so far as it is mental. The difference between an involuntary movement of the leg and a voluntary one, is, that whereas the involuntary one takes place without any previous consciousness of the movement to be made, the voluntary one takes place only after it has been represented in consciousness: and as the representation of it is nothing else than a weak form of the psychical state accompanying the real movement, it is nothing else than a nascent excitation of all the nerves concerned, which precedes their actual excitation. Hence the difference is, that whereas, in the case of the involuntary movement, the psychical states accompanying the impression and the action, are so coherent that the one follows the other instantaneously; in the voluntary movement they are so imperfectly coherent, that the psychical state accompanying the action does not follow instantaneously, but slowly —is partially excited before it is fully excited; and so occupies consciousness for an appreciable time before it actually occurs. And thus the cessation of automatic action and the dawn of volition, are one and the same thing.

It is quite true, as incidentally admitted in the preceding paragraph, that as we advance from the earliest and simplest manifestations of Will to the later and more involved ones, the composite state of consciousness by which any act is preceded, includes much beyond the nascent motor changes; and even much beyond the various nascent sensory impressions which must be immediately realized by the act. It further includes an extensive aggregation of nascent sensory impressions such as have before been more or less remotely realized by the act; and which constitute representations of the various consequences of the act. Even when Will is but

incipient, there must be some accompaniment of this kind. Along with any two conflicting sets of motor changes produced by an indistinctly cognized impression, there will become nascent the several pleasurable or painful psychical states which have in experience been respectively connected with such motor changes. These are aggregated with the various other psychical states, actual and nascent, which the impression immediately or mediately excites; and so, by increasing the group of psychical states which are severally coherent with the appropriate motor changes, add to the tendency which those motor changes have to take place. Gradually, by that ever-progressing aggregation of psychical states described in the last chapter, these nascent sensory impressions such as have been before more or less remotely realized by the act, come to form by far the greater part of the composite psychical state which precedes the act—constitute the greater part of what we call the desire to perform the act; and so, greatly obscure that original relation between impressions and motions which forms their nucleus. But the general nature of the process remains throughout fundamentally the same as at first. Certain impressions, immediately made upon the senses or afterwards mediately suggested by some other impressions, make nascent certain appropriate motor changes, and certain impressions connected with such changes; these, again, make nascent other changes, and other impressions; and so on to all degrees of remoteness: producing a complicated group of ideal actions and consequences. All of these having, directly or indirectly, some connection in experience with these motor changes, or with some antagonistic ones, tend to produce or prevent the action. An immense number of nascent psychical states are aroused, part of which unite with the original impression in exciting the action, and part of which are aggregated as exciters of some antagonist action; and when eventually, from their greater number or intensity, the first outbalance the others, it is simply that, as an accumulated stimulus, they become

sufficiently strong to make the nascent motor changes pass into actual ones.

But that Will comes into existence through the increasing complexity and imperfect coherence of automatic changes, is most clearly seen in the converse fact, that when changes which were once incoherent and voluntary, are very frequently repeated in experience, they become coherent and involuntary. Just as any set of psychical changes originally displaying Memory, Reason, and Feeling, cease to be conscious, rational, and emotional, as fast as by constant repetition they become more closely organized; so do they at the same time cease to be voluntary. Memory, Reason, Feeling, and Will, simultaneously disappear in proportion as, by their habitual recurrence, any psychical changes become automatic. Thus, while the child learning to walk, wills each movement before making it; the adult, when setting out anywhere, does not think of his legs, but of some point towards which he wishes to move; and his successive steps are made with little or no more volition than his successive inspirations. Every one of those vocal imitations made by the child in acquiring its mother tongue, or the man in learning a new language, is voluntarily made; but after many years of practice, conversation is carried on without any thought of the muscular adjustments required to produce each articulation: the motions of the vocal apparatus respond automatically to the trains of ideas. Similarly with writing, and all other familiar processes: the many coordinations by which they were once executed deliberately and voluntarily, have become so coherent and rapid, that they no longer occupy any appreciable space in consciousness; but under the appropriate external or internal stimuli, they follow unthinkingly, involuntarily. Not only is this so with actions daily occurring in the lives of all, but it is so with those peculiar to persons having special habits; and every one from time to time hears of the curious results hence arising: as of the old soldier who lets fall what he is carrying on the word "attention" being shouted behind him. And the same general truth

is recognized in the common remark, made of any one who has long persisted in some evil practice, that "he has lost power over himself," "can no longer control himself:" that is to say, by constant repetition certain psychical changes have more or less passed from the voluntary into the automatic.

§ 207. Long before reaching this point, most readers will have perceived that the doctrines developed in the last two parts of this work, are quite at variance with the current tenets respecting the freedom of the Will. That every one is at liberty to do what he desires to do (supposing there are no external hindrances), all admit; though people of confused conceptions commonly suppose this to be the thing denied. But that every one is at liberty to desire or not to desire, which is the real proposition involved in the dogma of free-will, is negatived as much by the internal perception of every one as by the contents of the preceding chapters. From the universal law that, other things equal, the cohesion of psychical states is proportionate to the frequency with which they have followed one another in experience, it is an inevitable corollary, that all actions whatever must be determined by those psychical connections which experience has generated—either in the life of the individual, or in that general antecedent life whose accumulated results are organized in his constitution.

To go at length into this long-standing controversy respecting the Will, would be alike useless and out of place. I can but briefly indicate what seems to me the nature of the current illusion, as interpreted from the point of view at which we have arrived.

Considered as an internal perception, the illusion appears chiefly to consist in supposing that at each moment the *ego* is something more than the composite state of consciousness which then exists. A man who, after being subject to an impulse consisting of a group of psychical states positive and nascent, performs a certain action, usually asserts that he determined to perform the action, and performed it under the influence of

this impulse: and by speaking of himself as having been something separate from the group of psychical states constituting the impulse, he falls into the error of supposing that it was not the impulse alone which determined the action. But the entire group of psychical states which constituted the antecedent of the action, also constituted himself at that moment—constituted his psychical self, that is, as distinguished from his physical self. It is alike true that he determined the action and that the impulse determined it; seeing that during its existence the impulse constituted his then state of consciousness, that is, himself. Either the *ego* which is supposed to determine or will the action, is some state of consciousness, simple or composite, or it is not. If it is not some state of consciousness, it is something of which we are unconscious—something, therefore, that is unknown to us—something, therefore, of whose existence we neither have nor can have any evidence—something, therefore, which it is absurd to suppose existing. If the *ego* is some state of consciousness, then, as it is ever present, it can be at each moment nothing else than the state of consciousness present at that moment. And thus it follows inevitably, that when any impression received from without, makes nascent certain appropriate motor changes and various of the impressions that must accompany and follow them; and when, under the stimulus of this composite psychical state, the nascent motor changes pass in actual motor changes; this composite psychical state which forms the stimulus to the action, is at the same time the *ego* which is said to will the action. Thus it is natural enough that the subject of such psychical changes should say that he wills the action; seeing that, psychically considered, he is at that moment nothing more than the composite state of consciousness by which the action is excited. But to say that the performance of the action is, therefore, the result of his free-will, is to say that he determines the cohesions of psychical states by which the action is aroused; and as these psychical states constitute himself at that moment, this is to say that these

psychical states determine their own cohesions: which is absurd. Their cohesions have been wholly determined by experiences—the greater part of them, constituting what we call his natural character, by the experiences of antecedent organisms; and the rest by his own experiences. The changes which at each moment take place in his consciousness, and, among others, those which he is said to will, are wholly determined by this infinitude of previous experiences; so far, at least, as they are not produced by immediate impressions on the senses.

This subjective illusion, in which the notion of free-will commonly originates, is strengthened by a corresponding objective illusion. The actions of other individuals, lacking as they do that constancy, that uniformity, habitually seen in phenomena known to obey fixed laws, appear to be lawless—appear to be under no necessity of following any particular order; and are so supposed to be determined by the unknown independent something which we call the Will. But, as I need hardly say, this seeming indeterminateness in the mental succession, is an illusion consequent upon the extreme complication of the forces in action. The composition of causes is so intricate, and from moment to moment so varied, that the effects are not calculable. Nevertheless, these effects are really as conformable to law as the simplest reflex actions. The irregularity and apparent freedom is a necessary result of the complexity; and equally arises in the inorganic world under parallel conditions. To amplify an illustration before used:—A body in space, subject to the attraction of a single other body, will move in a direction that can be accurately predicted. If subject to the attraction of two bodies, its course will be but approximately calculable. If subject to the attraction of three bodies, its course can be calculated with still less precision. And if it is surrounded by bodies of all sizes, in all directions, at all distances, its motion will be apparently independent of the influence of any of them; it will move in some indefinable varying line that appears to be self-determined; it will seem to be *free*. And in the same way, just in proportion as the cohesions of

each psychical state to others, become great in number and various in degree, the psychical changes will become incalculable and apparently subject to no law.

To reduce the general question to its simplest form :—Psychical changes either conform to law or they do not. If they do not conform to law, this work, in common with all works on the subject, is sheer nonsense : no science of Psychology is possible. If they do conform to law, there cannot be any such thing as free-will.

§ 208. Respecting this matter I will only further say, that free-will, did it exist, would be entirely at variance with that beneficent necessity displayed in the progressive evolution of the correspondence between the organism and its environment. That gradual advance in the moulding of inner relations to outer relations, which has been delineated in the foregoing pages—that ever-extending adaptation of the cohesions of psychical states to the connections between the answering phenomena, which we have seen to result from the accumulation of experiences, would be arrested, did there exist anything which otherwise determined their cohesions. As it is, we see that the correspondence between the internal changes and the external coexistences and sequences, must become more and more complete. The continuous adjustment of the vital activities to the activities in the environment, must become more accurate and exhaustive. The life must become higher and the happiness greater—must do so because the inner relations are determined by the outer relations. But were the inner relations to any extent determined by some other agency, the harmony at any moment subsisting, and the advance to a higher harmony, would alike be interrupted to a proportionate extent : there would be an arrest of that grand progression which is now bearing Humanity onwards to perfection.

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